

中国东南部中鱈魚的新資料 及其系統位置的討論*

張 弥 曼

(中国科学院古脊椎动物与古人类研究所)

1933年秉志、閻敦健研究了采自浙江寿昌东村的魚化石,建立了一属(*Mesoclupea*)两种(*M. showchangensis* 及 *M. globicephala*),并将此属归入鱈科 (*Clupeidae*),认为含魚化石地层的时代是早白堊世。

近年来,由于区测工作的开展,在浙江发现了大量中生代晚期魚化石。我所陸續收到在浙江寿昌、建德、諸暨、淳安、临海等地采得的大批中鱈魚化石。对含中鱈魚地层的时代問題,各家也有不少爭論。基于这些情况,我們认为有必要对中鱈魚作进一步的观察和研究。

这次我們观察的中鱈魚化石,包括 1935 年至 1936 年陈愷、郭鴻俊在浙江寿昌东村白水岭采集的 27 块标本 (V. 2683. 1—27), 1957 年浙江省蓮花峯采石場寄来产于諸暨武泄連石岭的 5 块标本 (V. 2684. 1—5) 和寿昌的 4 块标本 (V. 2683. 28—31), 1960 年至 62 年浙江省区测队寄来临海城西山头許及山头何的 11 块标本 (V. 2685. 1—11), 1960 年地質古生物研究所李星学先生寄来寿昌东村的一块标本 (V. 2683. 32) 及我所浙江队 1961 年、1962 年在寿昌河南村采得的一块标本 (V. 2683. 33) 和在临海城西山头許采得的 39 块标本 (V. 2685. 12—50)。在工作过程中,还参考了地質部地質科学研究所古生物地层室收藏的产自寿昌的中鱈魚化石和地質部地質博物館收藏的寿昌、諸暨等地的中鱈魚化石。淳安獅城甘塢的中鱈魚化石已寄回浙江省地質局,我所只留有照片及特征記述。

在工作过程中,得到刘宪亭、刘东生二先生的热心指导,秉志教授的热情鼓励,苏德造同志的耐心帮助,笔者向他們表示最大的謝意。此外,浙江省区测队的同志們帮助采集化石,地質部地質科学研究所古生物地层室、地質部地質博物館及中国科学院动物研究所的同志們提供参考标本,笔者在此一并致謝。

标 本 記 述

目 *Isospondyli*

科 *Chirocentridae*

属 *Mesoclupea* Ping et Yen 1933

属的特征: 体紡錘形。二頂骨間的骨縫几为直綫,仅后部略被上枕骨分开,上枕脊极

* 1963 年 4 月 9 日收到。

微弱。头部感觉沟系统与典型的真骨鱼类相同。眼眶大。眶前距短。口裂斜，上颌骨拱曲，口缘有排列紧密的细齿。齿骨中部上拱，前上颌骨及齿骨前部有锥形小齿。辅上颌骨二块。鳃条骨纤细，无喉板。前鳃盖骨上下枝外缘相交成直角，有较多的感觉沟分枝。鳃盖骨略呈长方形。脊椎骨化，椎体中部收缩不明显，几为圆筒状。在背鳍以前的神经弧未愈合。有上神经棘（supraneural）及上髓弓小骨（epineural）无后匙骨（postcleithrum）。胸鳍位低，较大。腹鳍很小。背鳍起点位于臀鳍起点之后，基短。臀鳍基长。尾鳍深分叉，尾下骨 7 枚。圆鳞，体侧鳞片高大于长。无棘鳞。

Mesoclupea showchangensis Ping et Yen

（图版 I—III）

1933 *Mesoclupea showchangensis*, 秉志、閻敦健, 中国地质学会志第十二卷, 第二期, 270—272 页, 图版 I, 图 1。

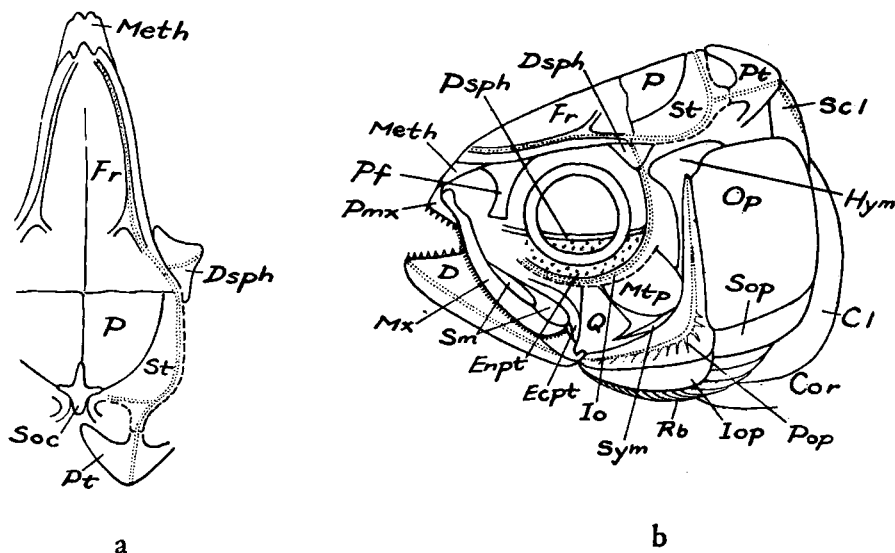
1933 *Mesoclupea globicephala*, 秉志、閻敦健, 同上, 272—273 页, 图版 I, 图 2。

新型标本：一条完整的鱼。古脊椎动物与古人类研究所登记号 V. 2685. 13。秉、閻所研究的 *M. showchangensis* 及 *M. globicephala* 正型标本已经遗失。

特征：除上述属的特征外，尚有下列几点：最大体高稍前于腹鳍起点。体长约为体高的 2.7—3.4 倍。头长略小于体高，略大于头高。吻钝。巩膜环（sclerotic）骨化。脊椎 53—54 个，每一脊椎有 4—5 个侧脊。腹鳍离胸鳍及臀鳍约等距。D III—11, A III—43, C I—17—I。

描述：体呈纺锤形。最大体高位于腹鳍起点处，体长约为体高的 2.7—3.4 倍，为头长的 3.4—4.1 倍（图版 I, 图 1, 2；图版 II, 图 1；图版 III, 图 1—3）。

头骨（插图 1a, b；图版 I, 图 4）——头长略大于头高，吻钝。额骨狭长，前部较窄，向后逐渐增宽，二额骨间骨缝几为直线，额骨表面有与粘液腺（mucus gland）有关的纵沟，由前端起，约行至额骨长之 2/3 处向内侧及外侧斜向分为二枝。顶骨略呈长方形，宽度约为长度的 2/3，较额骨后部稍窄，二顶骨间以直线相接，仅后部略被上枕骨分开（图版 I, 图 3）。上枕脊极微弱。未见顶骨凹线（pit-line）。眶前距很短，约相当于眼径的 1/2—2/3。中筛骨（mesethmoideum）在 V716-2 号标本（现存地质部地质博物馆）上保存有清晰的印痕。前额骨位于眼眶前缘上方。顶骨外侧有上颞骨（supratemporal）。向后紧接着上颞骨的是后颞骨（posttemporal），后颞骨向前分出三枝，上枝最长，呈片状，前端复于上耳骨上；中枝与上颞骨毗连；下枝极细，呈棒状。头部感觉沟系统与典型的真骨鱼类相同：眶上感觉沟沿额骨外缘向后延伸，经上颞骨、后颞骨中枝及上匙骨（supracleithrum）后缘转入体部侧线系统。眼眶大，眼径约等于头长的 1/3。有骨化的巩膜环。未见眶上骨（supraorbital）。下眶骨（infraorbital）狭，仅较其上之感觉沟稍宽，保存极差，数目不能辨数。膜质蝶耳骨（dermosphenoticum）略呈三角形，眶上感觉沟经此骨转入眶眶骨。副蝶骨（parasphenoidium）横贯眼眶中下部，下缘未见牙齿。口裂较倾斜，中等大。上颌骨拱曲，口缘具有锥形细齿，排列紧密。上颌骨后部上方有二辅上颌骨。前上颌骨小，有锥形齿，与上颌骨共同组成口裂上缘。下颌骨长于上颌。齿骨下缘较平直，上缘中部略隆起，但不如 *Leptolepis* 显著，前部有锥形齿，有感觉沟沿下缘通过。有关节骨，未见隅骨。前鳃盖骨呈

插图 1 *Mesoclupea showchangensis* 的头骨

a. 頂視, b. 左側視。 Cl, 匙骨; Cor, 烏喙骨; D, 齿骨; Dsph, 膜質蝶耳骨; Ecpt, 外翼骨; Enpt, 內翼骨; Fr, 額骨; Hym, 舌颌骨; Io, 围眶骨; Iop, 間鰓盖骨; Meth, 中篩骨; Mtp, 后翼骨; Mx, 上顎骨; Op, 鰓盖骨; P, 頂骨; Pf, 前額骨; Pmx, 前上顎骨; Pop, 前鰓盖骨; Psph, 副蝶骨; Pt, 后顳骨; Q, 方骨; Rb, 鰓条骨; Scl, 上匙骨; Sm, 輔上顎骨; Soc, 上枕骨; Sop, 下鰓盖骨; St, 上顳骨; Sym, 鰓骨。

鐮形,上枝与下枝外緣相交成直角,上枝窄长,下枝較寬短。感觉沟由此骨中部通过,向下及向后分出約 12 个分枝。鰓盖骨略呈长方形,前下角稍向下延伸,后下角較圓鈍,其寬度略大于高度的 1/2,前緣略厚,表面平滑,仅具輕微放射紋。下鰓盖骨及間鰓盖骨略呈长三角形。鰓条骨很纤细,寬度向后略增,可观察到十余对鰓条骨。舌颌骨近于垂直,下端稍向前傾,上部寬,下部狹。方骨与下顎关节骨相連,略呈三角形,下緣有一細长骨突。續骨呈棒状,插入方骨及其下緣骨突之間。后翼骨 (metapterygoideum) 較大,略呈半圓形。內翼骨 (entopterygoideum) 呈半圓形,上緣与副蝶骨相接,內面有細齿。外翼骨 (ectopterygoideum) 长而窄,弯曲,后緣与方骨相接。

脊柱(插图 2)——脊椎骨化,椎骨 53—54 个,其中尾椎 30 个,軀椎 23—24 个。脊柱前端椎体未愈合。椎体中部收縮不明显,几乎为圓筒状,高大于长,每一椎体約有 4—5 个側脊,最后五个尾椎向上揚。在背鰭以前的神經弧未愈合。肋骨 23—24 对,細长,除最后几对肋骨較短外,其余几达腹緣。由头后至背鰭起点前有一列細长的上神經棘,每一小骨片略呈 S 形,上端尖細,下端略寬扁,愈靠近头后的下端愈寬。在背鰭以前可以观察到一系列肌間骨 (intermuscular bones),即从各神經弧基部生出向后上方伸延的上髓弓小骨。

鰭及肩带(插图 2,图版 I,图 1, 2;图版 II,图 1;图版 III,图 1—3)——上匙骨狭长,上端伏于后顳骨下,下端盖在匙骨上,头部感觉沟的末段通过此骨上端。匙骨 (cleithrum) 碩大,弯曲,形状不規則,縱向有一脊,匙骨在脊后向外突起,在脊前向內凹陷。无后匙骨 (postcleithrum)。肩胛骨保存极差。烏喙骨較寬大,二烏喙骨在胸前形成龙骨状构造。胸鰭位低,較大,鰭条約 12 根,第一鰭条最长,很粗壮,不分叉,伸达腹鰭起点;其余鰭条在远端分叉分节。腹鰭很小,其起点距胸鰭及臀鰭約相等或略近于臀鰭,鰭条約 6 根。背鰭起

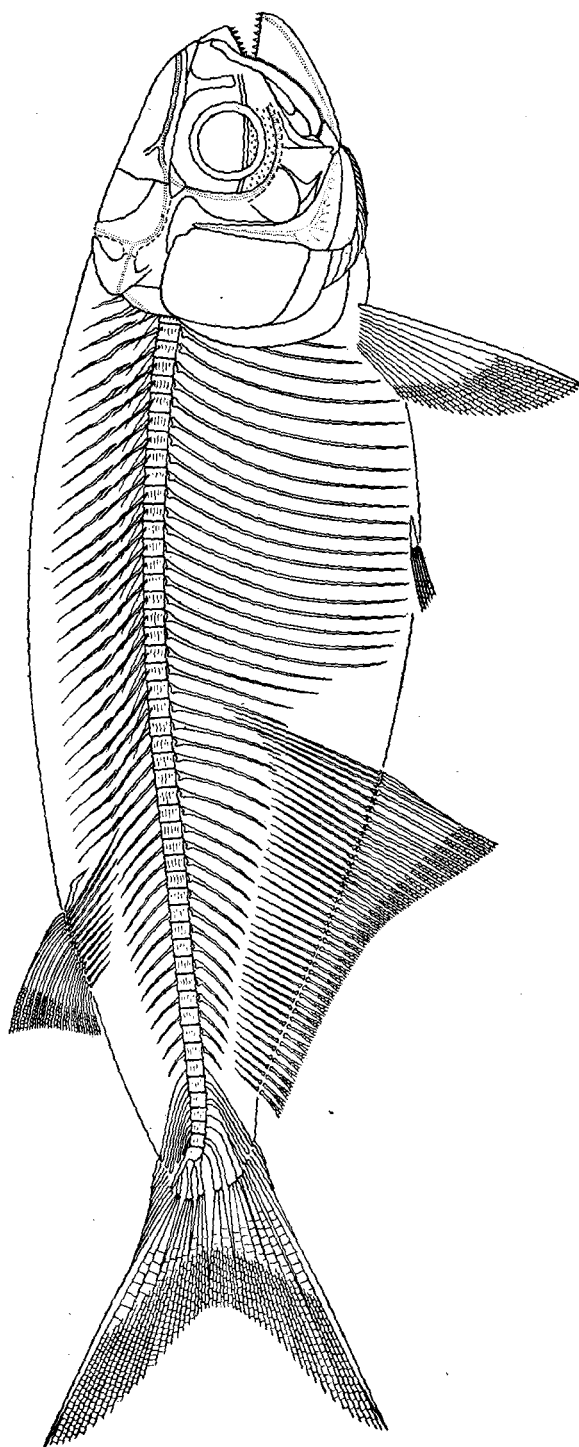


插图 2 *Mesoclupea shouchangensis* Ping et Yen 复原图

点远居于臀鳍起点之后,基短,鳍条约 14 根,前 3 根为不分叉鳍条,其中第 1、2 根短小,第 3 根最长,其余鳍条在远端分叉分节,长度向后渐减,背鳍后缘略成弧形。背鳍支持骨 14 根,第一支持骨较短,呈扁平状,但远端变尖;第二支持骨最长,插于第 29 及第 30 脊椎之神经棘间;其余支持骨的长度向后依次递减。臀鳍基很长,鳍条 43 根,前三根为不分叉鳍条,其中第 1、2 两根较短,第三根最长,其余鳍条在远端分叉分节,前 14 根鳍条长度减短较剧,自第 15 根鳍条后,长度减短得较少,形成突出的前叶。鳍条支持骨约 41 根,第一支持骨特别长,插于第 24 与 25 脊椎脉棘之间。尾鳍深分叉,鳍条 $I + 17 + I$ 根,上叶 10 根,下叶 9 根。鳍条自基部即分节,远端分叉,节长大于节宽。尾鳍上叶鳍条由三个尾下骨(hypural)支持,下叶鳍条被四个尾下骨支持,以下数第三个尾下骨最大。尾下骨基部较膨大,远端较宽扁。

鳞(图版 II, 图 2—4)——圆鳞,生长纹细密,未见明显的放射纹,前缘(基部)较平直,形成较明显的侧基角(latero-basal angles),后缘(顶部)成圆形,中心(nucleus)靠近后缘。体侧鳞片高大于长,约相当于长的 1.5 倍以上。鳞片表面似有极薄的珧瑯质层。

新型标本测量(单位:毫米)

Measurements (in mm) of Neotype

全长 (total length)	116
体长 (body length)	96
体高 (body depth)	28
头长 (skull length)	27
头高 (skull depth)	24
眶径 (transverse diameter of the orbit)	10
眶前距 (distance from rostrum to anterior margin of orbit)	6
眶后距 (distance from posterior margin of orbit to posterior border of opercular)	11
背鳍起点至吻端距 (distance from rostrum to anterior border of dorsal fin)	67
臀鳍起点至吻端距 (distance from rostrum to anterior border of anal fin)	60
背鳍起点至尾鳍基距 (distance from anterior border of dorsal fin to the base of caudal fin)	27
腹鳍起点至胸鳍起点距 (distance from anterior border of pelvic fin to anterior border of pectoral)	18
腹鳍起点至臀鳍起点距 (distance from anterior border of pelvic fin to anterior border of anal fin)	18
背鳍基 (length of dorsal fin base)	8
臀鳍基 (length of anal fin base)	26
尾柄长 (length of caudal pedicle)	11
尾柄高 (depth of caudal pedicle)	11

討 論

1. 秉、閻将浙江寿昌东村的魚化石与現生鲱属 (*Clupea*) 对比,定名为 *Mesoclupea*,并归入鲱科 (Clupeidae)。我們观察了数量較多的 *Mesoclupea* 标本,认为这一类魚和鲱科魚类差別較大。鲱科魚类的上枕骨很发育,完全分开頂骨,頂骨很小,同时,鲱科魚类具正型尾,肩带中有后匙骨,背鳍几乎位于身体中部。但 *Mesoclupea* 的上枕骨却很不发育,二頂骨間以直綫相接,仅后部略被上枕骨分开;并且最后五个尾椎显著地上揚,肩带中无

后匙骨,背鳍起点在臀鳍起点之后。因此,我们认为,从新资料中所观察到的特点来看,把 *Mesoclupea* 列为鲱科的一属是不够恰当的。另一方面, *Mesoclupea* 的头骨构造与美鳞鱼科 (Leptolepidae) 有不少相似之处。但只要根据头部感觉沟系统的分布就能把它立即和美鳞鱼科区分开来,美鳞鱼科头部感觉沟系统的分布还是古鳕鱼类型的,而 *Mesoclupea* 头部感觉沟系统的分布已是真骨鱼类型的了。此外,美鳞鱼的上枕骨极不发育、不分开顶骨、背鳍一般位于体长中部及臀鳍基短等特征也和 *Mesoclupea* 很不相同。所以,也不能把 *Mesoclupea* 归入美鳞鱼科。根据我们的观察, *Mesoclupea* 的上枕骨部分分开顶骨 (V. 2683. 11)。耳区较突出。吻钝,口裂开向斜上方,前上颌骨与上颌骨共同组成口裂上缘,辅上颌骨二块。鳃盖系统完全,有鳃条骨,无喉板。后颞骨与脑颞后侧角相接 (V. 2683. 32)。脊椎骨化,无横突,肋骨几乎完全包围腹腔,尾部脉弧愈合。无棘鳞。鳍条远端分叉分节,背鳍与臀鳍相对,基短,臀鳍基长,胸鳍大,腹鳍小 (V. 2685. 12; V. 2685. 13; V. 2684. 1; V. 2684. 2)。这些特点完全符合宝刀鱼科 (Chirocentridae) 的特征 (Günther, 1868; Woodward, 1901)。因此,我们认为应该把 *Mesoclupea* 归入宝刀鱼科。种属名称仍沿用秉、閻的 *Mesoclupea showchangensis*。

2. 秉、閻将寿昌东村的 *Mesoclupea* 分为 *M. showchangensis* 及 *M. globicephala* 两种,他们认为二者在很多方面都十分相近,仅后者头部轮廓稍圆,胸鳍并不决然地 (decidedly) 大于背鳍。但我们观察了数量较多的标本(其中也包括采自寿昌东村的标本),均未发现秉、閻所指出的两点差别;而且,从秉、閻的图版上可以看出, *M. globicephala* 的头部前端和胸鳍远端都有些残缺。另一方面,我们所观察的采自寿昌、诸暨、临海、淳安等地的标本在各部形态特征方面都相同,仅在体型上略有差别(体长与头长之比为 3.4—4.1; 体长与体高之比为 2.7—3.4)。我们把上述各地点的标本中凡能测量的都进行了测量,根据测量数据作了两个图(插图 3, 4)。从图上可以清楚看出,体长和头长、体长和最大体高之间基本上是直线关系。看来体型上的一些变化可能是由于个体变异、测量误差、保存条件的不同等所致。因此,我们认为, *M. globicephala* 实为 *M. showchangensis* 的同种异名。同时,由上述各地采集的 *Mesoclupea* 看来应属于同一种。

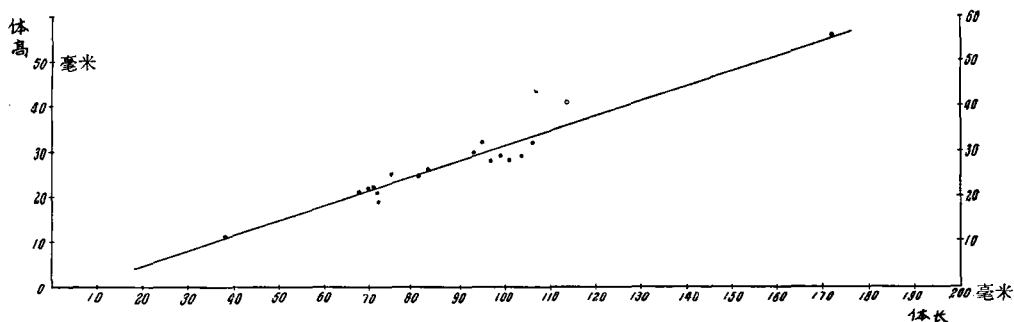
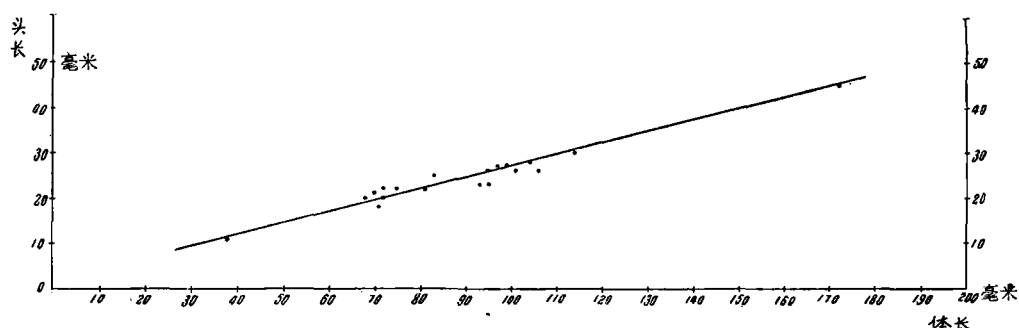


插图 3 *Mesoclupea showchangensis* 体长和体高的变化

3. *Mesoclupea* 在形态上和欧洲晚侏罗世—早白垩世的 *Thrissops* 十分相近。1833 年 Agassiz 根据德国 Solnhofen 的鱼化石建立了 *Thrissops* 一属。Woodward (1895, 1901) 把它归入美鳞鱼科,但指出, *Thrissops* 和 *Chirocentrus* 有密切关系。此后 Zittel (1902,

插图 4 *Mesoclupea globicephala* 体长和头长的变化

1932, 英譯本) 及 Romer (1933) 等仍将 *Thrissops* 保留在美鱗魚科中。直到 1945 年 Saint-Seine 在研究法国 Cerin 地方魚化石时, 才根据 *Thrissops* 的上枕脊突出、部分分开頂骨、耳区突出等特点, 正式把 *Thrissops* 归入宝刀魚科。宝刀魚科是 Cuvier 和 Valenciennes (1846) 根据現生宝刀魚 *Chirocentrus dorab* 建立的。Woodward (1901) 归入宝刀魚科的有从早白堊世到現代的九个化石属和一个現生属。在 Zittel 的分类中, 除 *Chirocentrus* 外, 仅将始新世的 *Platinx* 归入宝刀魚科, 而把其余白堊紀的种属归入 Crook 所建立的 Ichthyodectidae。按照 Saint-Seine 的分类, 宝刀魚科除包括 Woodward 所归入的白堊紀种属外, 又增加了晚侏罗世的 *Thrissops* 及 *Pachythrissops*。以后, Arambourg (1954) 等也采用了 Saint-Seine 的分类。但在 1955 年 Romer 的 “Vertebrate Paleontology” 和 Берг 的 “Система рыбообразных и рыб, ныне живущих и ископаемых” 再版中却仍然保留了 Woodward 和 Zittel 的分类(見表 1)。

表 1 (Tab. 1)

时 代	作 者 属 名	Wood- ward 1895, 1901	Zittel 1902, 1932	Saint- Seine 1949	Aram- bourg 1954	Romer 1955	Берг 1955		本 文								
E ₂	<i>Chirocentrus</i>	Chirocentridae	Chiro- centri- dae	Chirocentridae	Chirocentridae	Chirocentridae	Chirocentroidei	Chirocentridae	Chirocentridae	Chirocentrinae							
K ₂	<i>Platinx</i>		Ichthyodectidae								Chirocentridae	Chirocentridae	Chirocentridae	Chirocentroidei	Ichthyodectidae	Chirocentridae	Ichthyodectinae
K ₂	<i>Ichthyodectes</i>																
K ₂	<i>Portheus</i>																
K ₂	<i>Prymnetes</i> ⁴																
K ₂	<i>Saurodon</i> ²																
K ₂	<i>Andreiopleura</i> ⁴																
K ₂	<i>Eubiodectes</i> ³																
K ₂	<i>Anaodopogon</i> ³																
K ₂	<i>Proportheus</i> ³																
K ₁ -K ₂	<i>Saurocephalus</i> ²																
K ₁	<i>Spathodactylus</i>																
K ₁	<i>Chiromystus</i>																
K ₁	<i>Chirocentrites</i>																
J ₃ -K ₁	<i>Thrissops</i>	Leptolep- idae	Leptolep- idae		Leptolep- idae		Leptolepidae		Thrissop- inae								
J ₃ -K ₁	<i>Pachythrissops</i>																
J ₃	<i>Mesoclupea</i> ¹																

注 1. 見本文。 2. Zittel 归入 Saurodontidae。 3. 見 Zittel (1932), Romer (1955)。 4. 見 Romer (1955)。

根据我们对 *Mesoclupea* 标本及现生宝刀鱼 *Chirocentrus nudus* 骨骼的观察及文献资料的研究看来, *Mesoclupea*、侏罗纪的 *Thrissops*、*Pachythrissops* 与白垩纪的 *Chirocentrites*、*Ichthyodectes*、*Portheus* 等及现生的 *Chirocentrus* 之间在形态上确有较显著的差别。*Pachythrissops* 的上枕骨不分开顶骨, *Thrissops* 及 *Mesoclupea* 的上枕骨仅部分分开顶骨(小于顶骨长度的 $1/3$), 这些属的齿骨中部都向上隆起, 齿细, 齿骨前部及前上颌骨上的牙齿不增大; 而在白垩纪至现代的各属中上枕脊很发育, 部分或完全分开顶骨, 齿骨上缘较平直, 牙齿大小不规则, 齿骨前端及前上颌骨上的牙齿显著地增大。其中白垩纪的种类一般体型都很大。看来 Saint-Seine (1949) 所作 *Chirocentridae* 系统演化图中认为 *Thrissops* 是 *Ichthyodectes* 的直接祖先, 而 *Ichthyodectes* 又是 *Chirocentrus* 的直接祖先这一看法是需要重新考虑的。因此, 我们认为仍有必要在宝刀鱼科中分出三个亚科, 即:

1) *Thrissopinae* 上枕骨不分开或部分分开顶骨(小于顶骨长度的 $1/3$), 齿骨中部上拱, 齿细, 齿骨前部及前上颌骨上的牙齿不显著增大。包括 *Thrissops*、*Mesoclupea* 及 *Pachythrissops*。

2) *Ichthyodectinae* 大型的、绝灭的肉食鱼类。齿骨上缘较平直, 有强壮的锥形齿, 牙齿常大小不一, 齿骨前部及前上颌骨上的牙齿常显著增大。上枕脊发达, 上枕骨部分或全部分开顶骨。包括 *Ichthyodectes*、*Potheus*、*Chirocentrites*、*Chiromystus*、*Spathodactylus* 等属。

3) *Chirocentrinae* 上枕骨完全分开顶骨。齿骨中部不上拱, 牙齿尖锐, 齿骨及前上颌骨上的牙齿显著增大。包括 *Chirocentrus*, 可能也包括 *Platinx*。

4. 由上所述, *Mesoclupea* 是 *Chirocentridae* 中比较原始的种类。而 *Mesoclupea showchangensis* 又与 *Thrissops* 晚侏罗世的种类 *T. formosus* 等比较相近。根据 Arambourg (1954) 及 d'Erasmus 的复原图看来, 白垩纪的 *Thrissops* 在上枕脊发育情况、上枕骨分开顶骨程度、颌部构造、鳃盖系统、鳍等方面, 都比晚侏罗世的 *Thrissops* 更加特化。因此, 我们认为 *Mesoclupea showchangensis* 所属的地层时代应定为晚侏罗世较恰当。寿昌、临海、诸暨、淳安等地含 *Mesoclupea* 的地层看来也都属于同一时代。

5. 从 *Mesoclupea* 的上枕脊极其微弱, 上枕骨仅略分开顶骨后部, 耳区突出不十分显著及体型较一般化等特点来看, 它似乎比 *Thrissops* 更原始些。*Thrissops* 大都产于河口相(如英国 Wealden 及 Purbeck 建造)或泻湖相(如法国 Cerin、德国 Solnhofen 等地)沉积中, 与软骨鱼类、总鳍鱼类、古鳕类、全骨类及真骨鱼类美鳞鱼科的大量属种共生。而 *Mesoclupea* 却产于淡水河湖相沉积中, 与其共生的鱼类有 *Sinamia* sp. 及其他真骨鱼类, 此外, 还有大量淡水瓣鳃类和叶肢介。因此, *Mesoclupea* 所保留的某些解剖学上的原始特征, 亦和其他中生代淡水鱼群因受生态环境的限制较同时期相应的海水鱼群更多地保留一些原始性质相一致。

Mesoclupea 除分布于浙江上述各地外, 在福建崇安赤石、永安吉山, 江西泰和等地也都陆续发现。本文对 *Mesoclupea* 的形态描述及系统位置的确定对我国东南沿海中生代晚期地层的研究也许能提供一些线索。上述各地的 *Mesoclupea* 和与它共生的其他数量众多、种类繁杂的真骨鱼类和硬鳞鱼类, 还有待今后进一步研究。

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NEW MATERIALS OF *MESOCLUPEA* FROM SOUTHEASTERN CHINA AND ON THE SYSTEMATIC POSITION OF THE GENUS

CHANG MEE-MAN

(Institute of Vertebrate Palaeontology and Palaeoanthropology, Academia Sinica)

(Summary)

The fossil fishes from Showchang, Chekiang, were first studied by C. Ping and T. C. Yen in 1933. They established for these fossil fishes a new genus *Mesoclupea* including two new species—*M. showchangensis* and *M. globicephala* and considered the genus belonged to the family Clupeidae. The geological age of the fossil-bearing horizon was suggested by them to be Early Cretaceous.

Recently, we have secured a large number of beautifully preserved specimens of *Mesoclupea* from Showchang, Linhai, Chuki, Kienteh and Chunan of Chekiang Province. The geological age of the fossil-bearing horizon will be discussed and clarified in the following together with some other related points.

DESCRIPTION OF THE SPECIMENS

Order Isospondyli**Family Chirocentridae****Genus *Mesoclupea* Ping et Yen 1933**

Diagnosis of genus: Body fusiform. Parietals in contact and separated by the supraoccipital only in posterior part. Supraoccipital crest very small. The lateral-line canal system on the head being that of the typical teleosts. Orbit considerable in size. Ethmoid region comparatively short. Gape oblique. Maxilla arched, with a slightly convex tooth-bearing border, dentary rising into a thickened elevation in its median part. Both premaxilla and dentary with conical teeth. Surmaxilla two in number. Branchiostegal rays delicate. Gular plate absent. Both limbs of preopercular joined each other at right angle, with many branches of sensory canal. Opercular rectangular. Vertebrae all well ossified, centrum nearly cylindrical, no distinct constriction at the middle part. Neural arches before the dorsal fin not yet fused. Supraneurals and epineurals present. No postcleithrum. Pectoral lowly situated and relatively large. Pelvic small. Origin of the dorsal fin behind that of anal. The former has a short base, while the latter has a very long one. Caudal fin deeply forked. Hypurals 7 in number. Scales cycloid. Flank-scales deeper than long. Fulcra absent.

***Mesoclupea showchangensis* Ping et Yen**

Neotype: A complete skeleton. Cat. No. V.2685.13.

Locality and horizon: Showchang, Linhai, Chuki, Chunan and Kienteh, Chekiang Province.

Diagnosis of species: Besides those generic characters given above, there are the following points: The maximum depth of body before the origin of the pelvic. Depth in length to base of caudal, 2.7—3.4. Head somewhat longer than deep, and its length less than depth of body. Snout obtuse. Sclerotic ossified. Vertebrae 53—54 in number. Each with 4—5 longitudinal ridges. Pelvic fins located about midway between the pectoral and anal fins. D. III-11, A. III-43, C. I-17-I.

Discussion:

1. Ping and Yen compared the fish remains from locality Tuntsun of Showchang with the genus *Clupea*, proposed for them the generic name *Mesoclupea*, and considered it as a member of Clupeidae. Through a detailed observation of a large number of the material recently obtained, it is found, however, that these fishes are distinct from Clupeidae clearly. In Clupeidae, the supraoccipital is well developed and separates the small parietals entirely. The caudal is homocercal. The postcleithrum of the pectoral girdle is present. The dorsal fin is located nearly at the middle of the body. But in *Mesoclupea* the supraoccipital bone is very small, the parietals are meeting in anterior part and separated by supraoccipital only in their posterior part. Besides, the last five caudal vertebrae in *Mesoclupea* are upturned and hence the caudal is not typical homocercal. There is no postcleithrum. The origin of the dorsal fin is situated behind that of the anal. According to these important differences it seems that the including of *Mesoclupea* in the family Clupeidae is inappropriate. On the other hand, the cranium

of *Mesoclupea* bears some resemblances to those of the members of Leptolepidae. But it can be readily distinguished from the latter by the different arrangement of the main lateral-line canal system on the head. In Leptolepidae it is that of the palaeoniscoids type, while in *Mesoclupea* it is of the teleosts type. The differences between *Mesoclupea* and leptolepids are also shown in the state of development of the supraoccipital, the disposition of the dorsal fin, the length of anal base, etc. Hence it is likewise incorrect to include *Mesoclupea* in Leptolepidae. Through a close study of the specimens of *Mesoclupea*, it is more reasonable to consider *Mesoclupea* as a member of the family Chirocentridae because it possesses the following basic characters: The supraoccipital bone partly separating the parietals in the median line (V.2683.11), otic region relatively prominent, snout not produced, gape of mouth more or less directed upward, both premaxilla and maxilla entering the upper border of the mouth, surmaxilla two in number, opercular apparatus complete, with branchiostegal rays, but no gular plate, post-temporal bone in contact with postero-lateral angles of cranium (V.2683.32); vertebral centra well ossified, no transverse processes, ribs nearly entirely encircling the abdominal cavity, haemal arches fused at the base of the tail, intermuscular bones present, fin fulcra absent, fin rays divided and closely articulated distally, dorsal fin with short base opposite to the anal, the latter with long base. Pectoral fin relatively large, pelvic very small (V.2685.12; V.2685.13; V.2684.1; V.2684.2). But the name *Mesoclupea showchangensis* of Ping and Yen can still be retained.

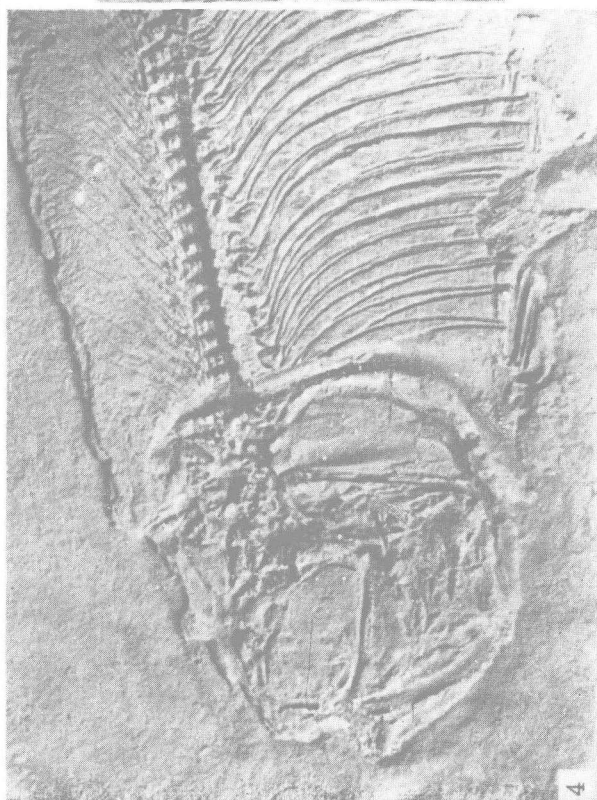
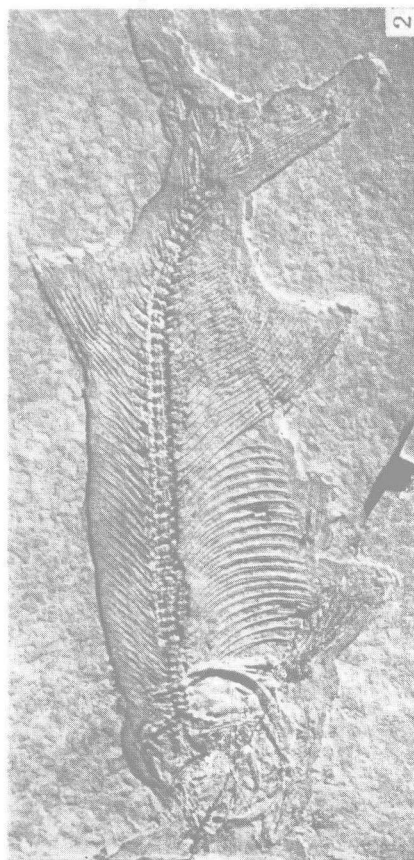
2. Ping and Yen divided *Mesoclupea* from Showchang into two species—*M. showchangensis* and *M. globicephala*. They thought that both species resemble each other in many respects, but the outline of the head of the latter species is round, and its pectoral fin is not decidedly larger than the dorsal as in the case of the former species. We have observed many specimens, including those collected from Showchang, but we did not find those differences. In the plate of Ping and Yen it could be clearly seen that the snout and the distal end of pectoral fin are not well preserved. On the other hand, the morphological details of the *Mesoclupea* specimens collected from Showchang, Linhai, Chuki, Chunan are similar to one another except that their body proportions vary somewhat. We have measured a great number of specimens, and two graphs were drawn according to these measurements (figs. 3, 4). It is distinctly shown in the graphs that in the main a linear relationship holds, either between the body length and the head length, or between the length and the maximal depth of body. Some minor differences in body proportions can be regarded as individual variations, error of measure, bad preservations, etc. So *M. globicephala* may be considered as the synonym of *M. showchangensis*, and all *Mesoclupea* specimens from the above mentioned localities belong to this very species.

3. *Mesoclupea* is morphologically akin to *Thrissops* from Upper Jurassic and Lower Cretaceous deposits of Europe. In 1833 basing on the fossil fishes from Solnhofen in Germany Agassiz established the genus *Thrissops*. As regards the systematic position of *Thrissops* there were several different opinions as shown in table I. Through our observations of *Mesoclupea* and the skeleton of *Chirocentrus nudus*, as well as a study of the related literatures, it is revealed that there are distinct differences between *Mesoclupea*, Jurassic *Thrissops*, *Pachythrissops*, and Cretaceous *Chirocentrites*, *Ichthyodectes*, *Potheus*, etc. and existing *Chirocentrus*. It seems to us that the idea contained in the systematic evolutionary scheme of Chirocentridae of Saint-Seine (1949) that *Thrissops* was the direct

图版 I 说明

寿昌中鱖鱼 *Mesoclupea shouchangensis* Ping et Yen

- 图 1 一条完整的鱼, 左侧视。V. 2684. 2, $\times 5$ 。
A complete fish in left view. V. 2684. 2, $\times 5$.
- 图 2 一条完整的鱼, 左侧视。V. 2684. 1, $\times 1$ 。
A complete fish in left view. V. 2684. 1, $\times 1$.
- 图 3 头部右侧视及俯视, 见上枕骨。V. 2683. 11, $\times 3$ 。
The skull in right and partly in dorsal view, showing the supraoccipital (Soc.), V. 2683. 11, $\times 3$.
- 图 4 头部左侧视。V. 2683. 32, $\times 3$ 。
The skull in left view, V. 2683. 32, $\times 2$.



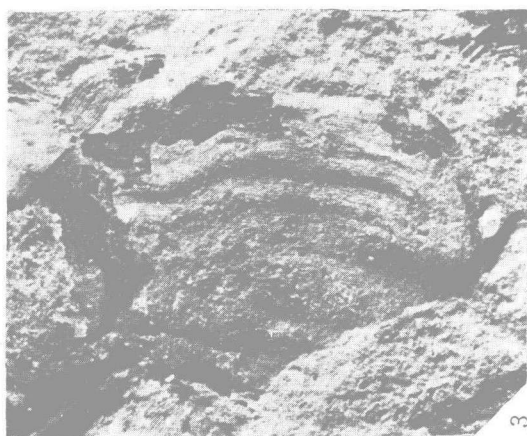
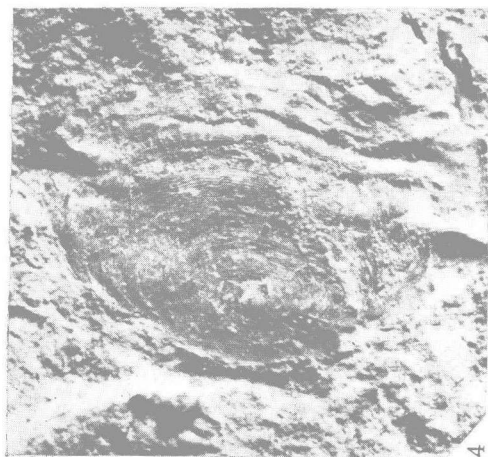
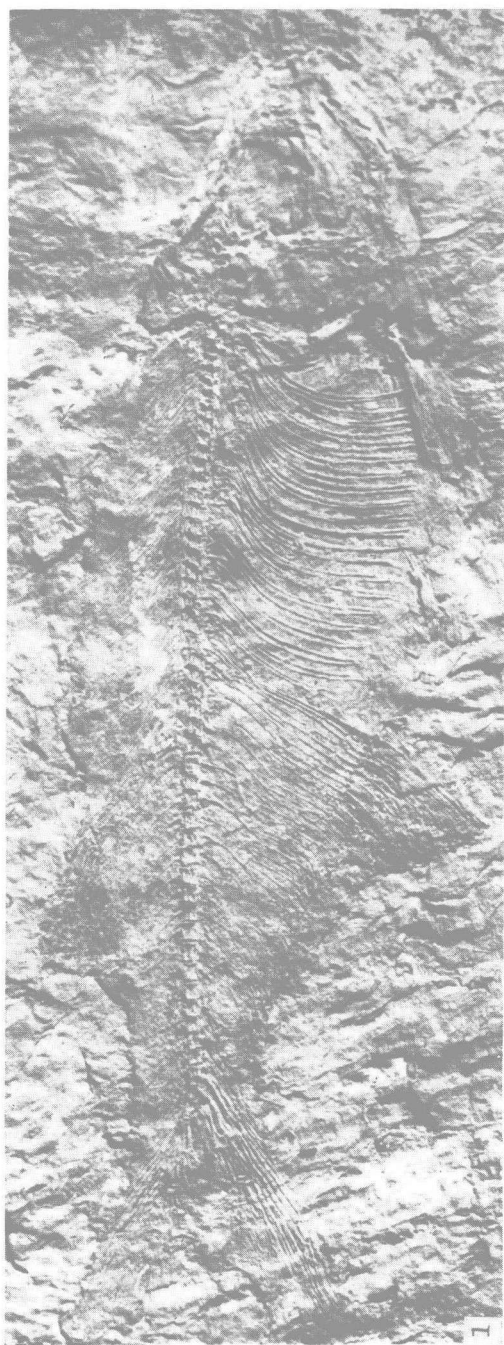


图 版 II 說 明

寿昌中鱗魚 *Mesoclupea showchangensis* Ping et Yen

- 图 1 一条完整的魚,右側視。×1.5。
A complete fish. Right side view. ×1.5.
- 图 2 体側鱗片。V. 2683. 33. ×10。
Isolated flank-scale. V. 2683. 33. ×10.
- 图 3 同上。
Ditto.
- 图 4 同上。
Ditto.

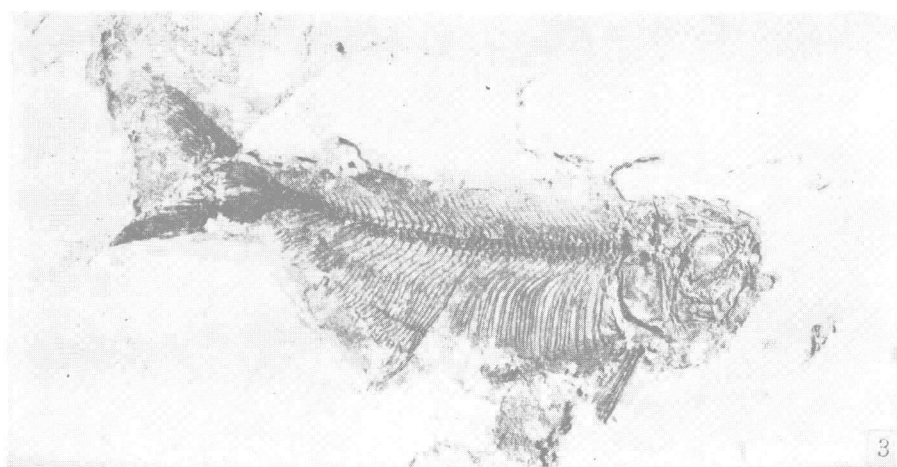
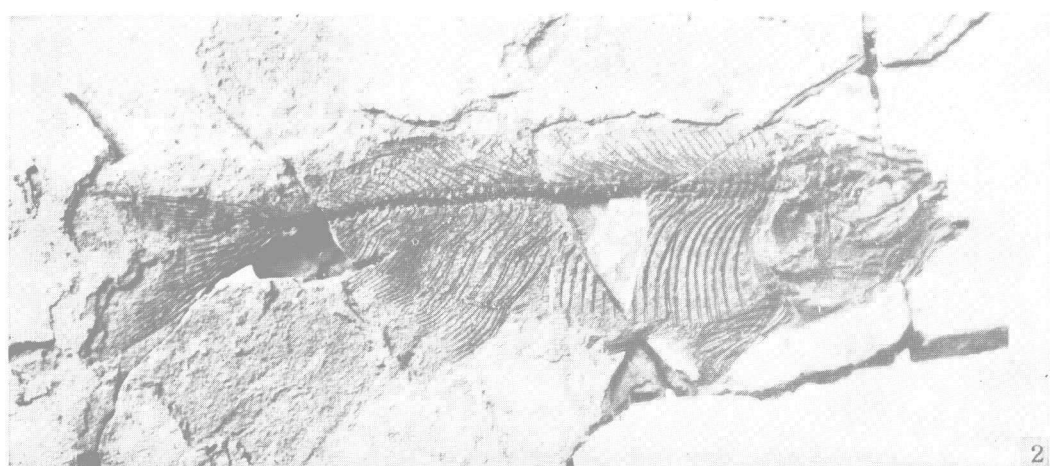
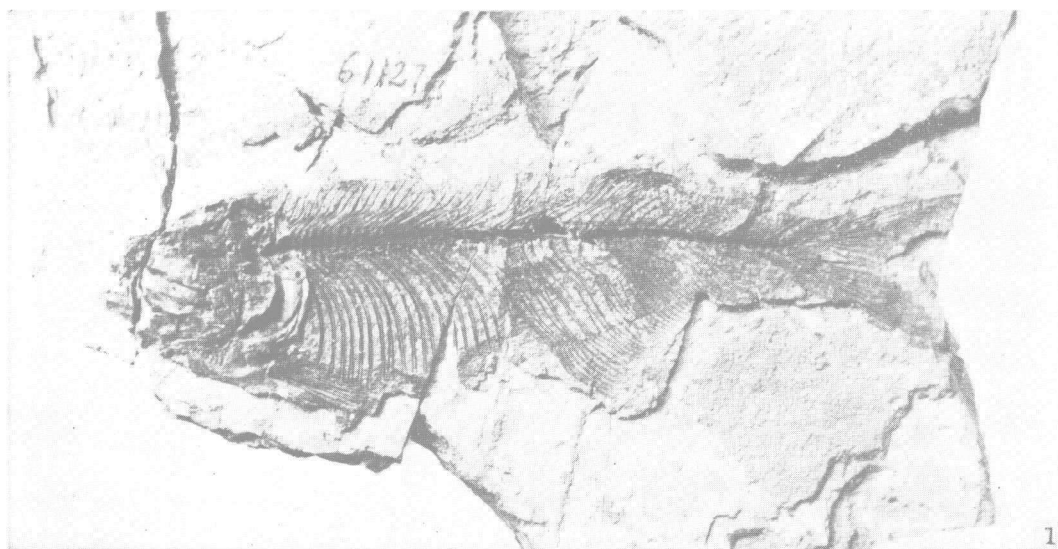


图 版 III 說 明

寿昌中鱖魚 *Mesoclupea showchangensis* Ping et Yen

- 图 1 新型标本,左侧視。×1。
Neotype, seen from left side. V. 2685. 12, ×1.
- 图 2 同上,右侧視。×1。
Ditto, right side view. ×1.
- 图 3 一条完整的魚,右侧視。V. 2685. 12, ×1。
A complete fish, seen from right side. V. 2685. 12, ×1.

ancestor of *Ichthyodectes*, and that the latter was the direct ancestor of *Chirocentrus* should be revised. Besides we deem it necessary to divide the family Chirocentridae into three subfamilies as follows:

1) Thrissopinae. Parietals not separated by supraoccipital or partly so (less than $1/3$ of the length of parietal). Dentary rising into an elevation in its median part, teeth fine, those on the premaxilla and anterior part of dentary not much enlarged. This subfamily includes *Thrissops*, *Mesoclupea* and *Pachythrissops*.

2) Ichthyodectinae. Large extinct predaceous fishes. Upper border of dentary more or less straight, with strong conical teeth, which are very irregular in size, and those of the premaxilla and anterior part of dentary often much enlarged. Supraoccipital crest well developed. Parietals separated by supraoccipital partly or completely. In this subfamily, *Ichthyodectes*, *Potheus*, *Chirocentrites*, *Chiromystus*, *Spathodactylus*, etc. are included.

3) Chirocentrinae. Parietals separated completely by supraoccipital. Dentary not rising into an elevation in its median part, teeth pointed, those on the premaxilla and anterior part of dentary much enlarged. This subfamily includes *Chirocentrus* and *Platinx*(?).

4. From the foregoing description *Mesoclupea* is considered as one of the primitive genera of Chirocentridae, and *M. showchangensis* is morphologically akin to Jurassic species of *Thrissops* such as *T. fomensis*, etc. We can see from Arambourg's (1954) and d'Erasmus's restorations, that the Cretaceous species of *Thrissops* are much more specialized in many respects than those of the Jurassic. Hence it is more appropriate that the geological age of the *Mesoclupea*-bearing horizon should be considered as Upper Jurassic rather than Lower Cretaceous. If so, then, *Mesoclupea*-bearing horizon in all above mentioned localities should belong to the same geological period, i.e. the Upper Jurassic.

5. In *Mesoclupea* the supraoccipital crest is very small, parietals are separated by supraoccipital posteriorly, otic region is not very prominent, body form is more generalized. Viewed from these characters it seems that *Mesoclupea* is more primitive than *Thrissops*. All the materials of the latter genus were discovered from the deposits of the estuary (Wealden and Purbeck beds, England) and lagoon (Solnhofen, Germany; Cerin, France) with a great number of elasmobranchs, crossopterygians, palaeoniscoids, holosteans and leptolepids. But *Mesoclupea* are collected from fluvial-lacustrine deposits with *Sinamia* sp., teleosts, and a great number of fresh-water shells and conchostracans. Thus, its primitive anatomical features are in accordance with those of members of other Mesozoic fresh-water fish-fauna, which, because of ecological restriction, preserved more primitive characters than did corresponding marine fish-fauna.

Besides in Chekiang Province *Mesoclupea* fossils were also discovered in Chungan, Yungan of Fukien Province, and Taiho of Kiangsi Province, etc.

The detailed morphological description and the ascertaining of the systematic position of *Mesoclupea* in this study may probably help us with a valuable clue for solving the stratigraphical problem of the late Mesozoic deposits of southeastern maritime regions of China.

As to the other teleost and ganoid fossil fishes, which are abundant both in number and species in the late Mesozoic deposits of Chekiang, a further study is awaited.