



# 白垩纪中期缅甸琥珀中陆生腹足类化石的新发现\*

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**摘要** 腹足类化石在地层中丰富且常见, 但在琥珀中保存较少。文中描述了产自白垩纪中期缅甸琥珀中的陆生腹足类化石 2 属 2 种: *Euthema naggsi* Yu, Wang and Pan, 2018, *Truncatellina dilatatus* sp. nov.。这些陆生腹足类新材料的发现, 提高了缅甸琥珀中陆生腹足类物种多样性, 并进一步印证了白垩纪中期缅甸琥珀森林温暖潮湿的热带雨林环境。

**关键词** 腹足类 缅甸琥珀 热带雨林 白垩纪中期

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## NEW MATERIAL OF TERRESTRIAL GASTROPODS FROM MID-CRETACEOUS BURMESE AMBER

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**Abstract** Gastropod fossils are abundant, but they are rarely preserved in amber. Two genera and two species of terrestrial gastropods *Euthema naggsi* Yu, Wang and Pan, 2018, *Truncatellina dilatatus* sp. nov. are described from mid-Cretaceous amber from northern Myanmar. Our findings offer more complete records of palaeontological diversity of terrestrial gastropods preserved in Burmese amber. The ecological context of amber gastropods further confirms the warm and humid tropical rain forest environment of the amber forest in the mid-Cretaceous.

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## SYSTEMATIC PALEONTOLOGY

## Superfamily Pupilloidea Turton, 1831

## Family Vertiginidae Fitzinger, 1833

*Truncatellina* Lowe, 1852

**Type species** *Pupa linearis* R.T. Lowe, 1852

**Diagnosis** Shell very small, nearly cylindrical-shape; embryonic shell blunt and dome-shaped; teleoconch whorls profile convex. Suture deep, well-marked, aperture sub-circular in shape, toothless or 1-3 teeth; surface ornamented by strongly prominent, oblique and longitudinal collabralirae distributed equally; apertural margin broadened, thickened and reflected (after Thiele, 1992; Salvador *et al.*, 2016).

*Truncatellina dilatatus* sp. nov.

urn:lsid:zoobank.org:act:3ED80760-5C38-4111-865E-C59CEE19B1CF

(Figs. 1-E, 1-F)

**Etymology** The species name is derived from the Greek *dilatatus*, meaning inflated.

**Material** Holotype, NIGP171282.

**Diagnosis** Shell very small, dextral, nearly cylindrical-shape; embryonic shell blunt and dome-shaped; teleoconch whorls profile convex. Suture deep, well-marked, aperture sub-circular in shape, apertural margin broadened, thickened and reflected; surface ornamented by strongly prominent, oblique and longitudinal collabralirae distributed equally; toothless.

**Description** Shell very small, height about 1.45 mm, width about 0.93 mm, nearly cylindrical-shape, consisting of about 5–6 rapidly increasing whorls. Apex blunt, apical angle near 110°. Embryonic shell low-conical, consisting

of one to two smooth whorls. Teleoconch whorls are inflated and grows rapidly. The width of teleoconch is greater than height. Body whorl coiling tight slightly; sutures straight and distinct and deeply impressed; aperture sub-circular in shape, apertural margin continuous and complete and strongly reflected; inner lip broader than outer lip, columellar lip nearly straight; surface ornamented by strongly prominent, oblique and longitudinal collabralirae distributed equally.

**Remarks** *Truncatellina dilatatus* sp. nov. is established based on the shell characters (such as minute size, deep sutures, slightly contractive body whorl, broadened and thickened apertural margin and no tooth) since there is no similarity shared within other species in *Truncatellina*. This new species shares some similarities with *T. cylindric* A. Férussac, 1807 from European on nearly cylindrical shell-shape, low whorls and toothless in aperture, it differs from the latter in much more deeply impressed suture and much minute size (*T. dilatatus* sp. nov.: shell height about 1.45 mm, shell width about 0.93 mm, *T. cylindric*: shell height 1.80–2.24 mm, shell width 0.91–1.01 mm); *T. dilatatus* sp. nov. resembles *T. callicratis* Scacchi, 1833 in shell size (*T. callicratis*: shell height 1.26–2.09 mm, shell width 0.76–0.96 mm), characters of sculpture, the difference is that *T. dilatatus* sp. nov. is toothless; *T. dilatatus* sp. nov. and *T. muscorum* Linné, 1943 from Pleistocene of Gansu Province are both toothless, however *T. dilatatus* sp. nov. is much smaller than *T. muscorum* (*T. muscorum*: shell height about 3 mm, shell width about 2 mm).

**Locality and horizon** Upper Albian–Lower Cenomanian; northern Myanmar.

**Key words** Gastropods, Burmese amber, rainforest, mid-Cretaceous

## 1 前 言

琥珀为生物体提供了一种独特的保存方式, 其中的生物体通常是陆生植物、微生物、节肢动物甚至脊椎动物遗骸, 它们往往成为三维保存的化石(Yu *et al.*, 2019)。

陆生腹足类包括极少数的前鳃亚纲(Prosobranchia)和大部分的肺螺亚纲(Pulmonata)类群, 广布于世界各地, 其化石常见于中生代地层(余汶等, 1982; Stworzewicz and Soltys, 1996), 但白垩纪化石记录相对较少(如: Roth, 1999; Naggs and Raheem, 2005; Isaji, 2010), 保存在琥珀中的腹足类化石更为稀少。最早的保存于琥珀

中的陆生腹足类记录是产自早白垩世(Hauterivian期)黎巴嫩琥珀的蛹螺超科(Pupilloidea)一个未定种(Roth *et al.*, 1996)。近年来, 在缅甸琥珀中发现的腹足类化石较为丰富, 包括环口螺科超科(Cyclophoroidea)的两个新属 *Euthema* (属于倍唇螺科 Diplommatinidae)和 *Cretatortulosa* (属于蛹螺科 Pupinidae?)(Yu *et al.*, 2018), 一个环口螺科(Cyclophoridae)的有软体组织的幼年个体(Xing *et al.*, 2019), 环口螺科、倍唇螺科和拟沼螺科(Assimineidae)几个新属种(Bullis *et al.*, 2020), 以及腹足类口盖、软体和排泄物等(Hirano *et al.*, 2019); 缅甸琥珀中除陆相腹足类外, 更珍贵的是保存有海相腹足类标本, 如与菊石化石共同保存

的 *Mathilda* sp. (Yu *et al.*, 2019)。陆相与海相腹足类保存在缅甸琥珀中印证了白垩纪中期琥珀森林古环境可能为滨海环境, 海浪裹挟海相腹足残骸进入森林, 并被树脂包裹经过地质作用形成。

## 2 材料与方法

研究材料为 3 块黄色透明琥珀包裹的陆生腹足类标本, 采自缅甸北部克钦邦胡康河谷德奈镇附近的 Noije Bum (26° 15' N, 96° 33' E)。关于克钦琥珀沉积地层的地质年代以往存有争议, Shi 等 (2012) 通过对缅甸琥珀上沉积物及岩屑中的锆石进行测年研究, 认为缅甸琥珀形成于约 99 Ma, 然而, 琥珀体的高度磨圆性及其表面存在的双壳钻孔都表明缅甸琥珀在其形成过程中存在二次搬运作用, 因此琥珀体年龄应比其包裹的沉积物老 (Smith and Ross, 2018)。Yu 等 (2019) 综合化石生物群和埋藏学分析结果也支持了同位素所测定的地质年代学的研究结果。

标本利用 Zeiss Axio Imager Z2 正置显微镜进行观察、度量和拍照, 为了获得更好的观察效果, 某些照片使用 Zen 2. 3 软件进行叠加处理。图版利用绘图软件 CorelDraw X4 和 Adobe Photoshop CS3 制作完成。标本编号 NIGP171280—NIGP171282, 现存于中国科学院南京地质古生物研究所。

文中度量缩写为: H. 壳高; D. 壳宽; h. 壳口高; d. 壳口宽。

## 3 系统古生物

环口螺超科 **Superfamily Cyclophoroidea Gray, 1847**

倍唇螺科 **Family Diplommatinidae Pfeiffer, 1856**

奇美螺属 **Genus *Euthema* Yu, Wang and Pan, 2018**

模式种 *Euthema naggsi* Yu, Wang and Pan, 2018

产地层位 缅甸北部; 上 Albian 阶—下 Cenomanian 阶。

纳氏奇美螺 ***Euthema naggsi* Yu, Wang and Pan, 2018**

(图 1-A—1-D)

2018 *Euthema naggsi* Yu, Wang and Pan, p. 255, fig. 1. A-B.

材料 NIGP171280 (图 1-A, 1-B); NIGP 171281 (图 1-C, 1-D)。

度量 NIGP171280: H = 2.2 mm; D = 1.04 mm; h = 0.65 mm; d = 0.56 mm。NIGP171281: H = 1.67 mm; D = 0.98 mm; h = 0.57 mm; d = 0.49 mm。

补充描述 壳体微小, 近圆柱形壳型, 右旋, 由 5—6 个规则增长的螺环组成。壳顶钝, 顶角约 80°。胎壳低锥型, 由两个多的光滑的圆的螺环组成。成年螺环圆凸, 宽度大于高度, 周缘位于螺环中部且圆凸。缝合线深陷、微倾斜。基部圆凸, 脐孔较小, 脐缝狭窄。壳口呈亚圆形, 口缘扩展且强烈翻转, 轴唇近直, 外唇圆拱状, 前端圆角状, 后端宽圆。表面饰有明显突出的斜纵向规则排列的肋条纹, 且体螺环处有弯曲、近 S 型。生长线之间的螺环面凹下且宽度不等。

讨论 标本 NIGP171280 和 NIGP171281 与同样产自白垩纪缅甸琥珀的模式标本存在细微区别: 新标本的螺环面更圆凸, 肋饰明显更粗, 属于种内差异。

产地层位 缅甸北部; 上 Albian 阶—下 Cenomanian 阶。

蛹螺超科 **Superfamily Pupilloidea Turton, 1831**

旋螺科 **Family Vertiginidae Fitzinger, 1833**

截线螺属 **Genus *Truncatellina* Lowe, 1852**

模式种 *Pupa linearis* R.T. Lowe, 1852

属征 壳体微小, 圆柱形壳体, 顶钝, 螺环膨胀圆凸; 口卵型, 无齿或 1—3 齿, 成年壳体饰有明显突出的肋条纹, 口缘略扩张, 且加厚、翻转 (Thiele, 1992; Salvador *et al.*, 2016)。

膨胀截线螺(新种) ***Truncatellina dilatatus* sp. nov.**

urn:lsid:zoobank.org:act:3ED80760-5C38-4111-865E-C59CEE19B1CF (图 1-E, 1-F)

词源 *dilatatus*, 拉丁词, 意为膨胀的。

材料 正模, NIGP171282, 度量: H = 1.45 mm; D = 0.93 mm; h = 0.57 mm; d = 0.59 mm。

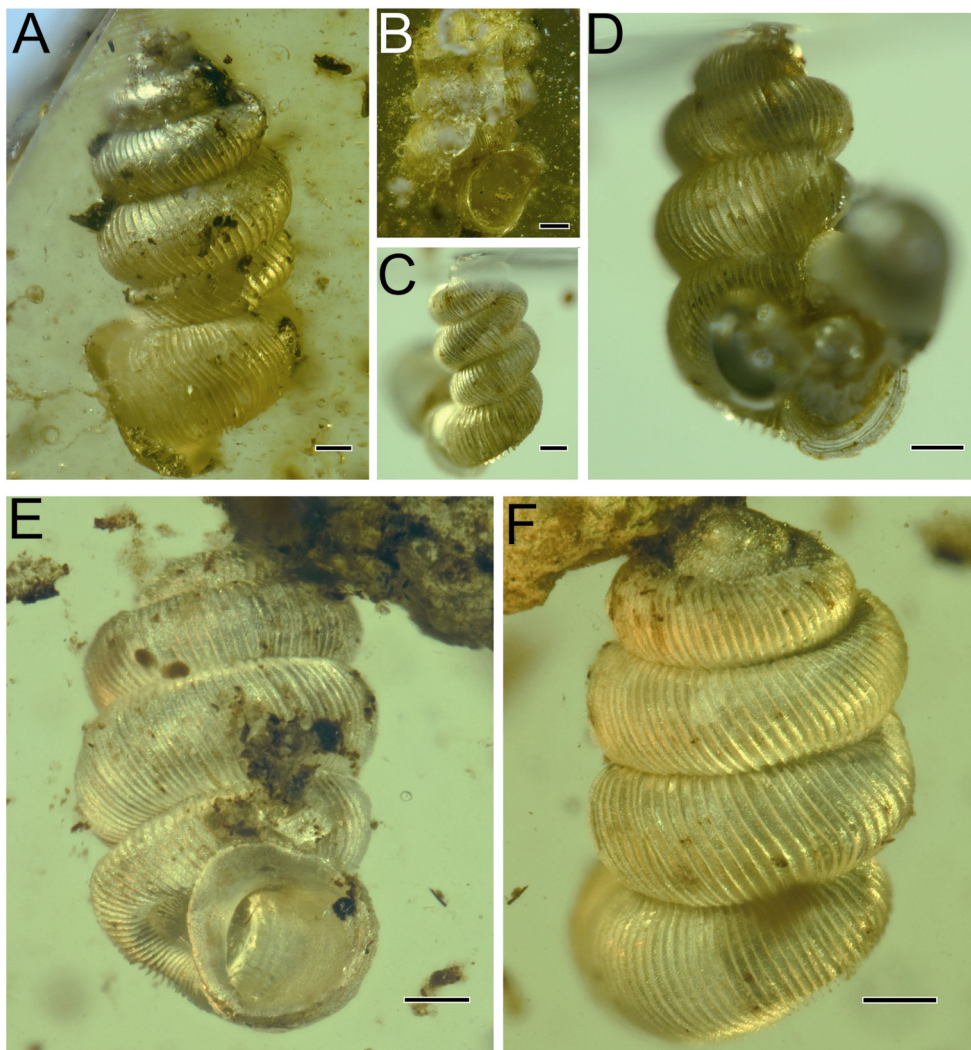


图 1 白垩纪中期缅甸琥珀陆相腹足类 2 种

Fig. 1 Two species of terrestrial gastropods from mid-Cretaceous Burmese amber.

A, B, C, D. *Euthema naggsi*, A, B. NIGP171280; C, D. NIGP171281, A. 背视(abapertural view); B. 口视(apertural view); C. 背视(abapertural view); D. 口视(apertural view), 比例尺(scale bars) = 0.2 mm. E, F. *Truncatellina dilatatus* sp. nov., NIGP171282, E. 口视(apertural view); F. 背视(abapertural view), 比例尺(scale bars) = 0.2 mm.

**特征** 壳体微小，右旋，近圆柱形壳型，胎壳低锥形，成年壳体增长快，壳体膨胀，体螺环收缩，缝合线深陷，壳口近圆形，口缘扩张加厚，壳面饰有明显突出且均匀分布的斜纵向有规则排列的肋条纹，无齿。

**描述** 壳体微小，壳高约 1.45 mm，宽度约为 0.93 mm，近圆柱形壳型，由 5—6 个快速增长的螺环组成。壳顶钝，顶角约为  $110^\circ$ 。胎壳小，低锥形，约由 1—2 个光滑螺环组成。胎壳至成年螺环增长快，壳体膨胀，螺环圆凸低矮，宽度明显大于高度，

体螺环略收缩。缝合线平直深陷。壳口呈近圆形，口缘连续完整，稍厚，且强烈外折，内唇较外唇扩张，外唇略破损，轴唇近直。壳面饰有明显突出且均匀分布的斜纵向有规则排列的肋条纹，无齿。

**比较** 当前描述标本由于壳体微小，缝合线深陷，体螺环略收缩，口缘扩张加厚，口部无齿等特征无法归入 *Truncatellina* 任一种，因此设立新种 *Truncatellina dilatatus* sp. nov.。新种与产自欧洲的 *Truncatellina cylindric* A. Férussac, 1807 在近圆柱形壳型、低矮的螺环及口部无齿等方面有

相似之处, 区别是前者的缝合线深陷, 且壳体更为微小, 壳高约 1.45 mm, 宽度约为 0.93 mm, 而 *T. cylindric* 壳高在 1.80—2.24 mm, 壳宽在 0.91—1.01 mm; *T. dilatatus* sp. nov. 与 *T. callicratis* Scacchi, 1833 在壳体大小 (*T. callicratis* 壳高 1.26—2.09 mm, 壳宽 0.76—0.96 mm), 壳面纹饰等方面有相似之处, 不同的是新种口部无齿 (David *et al.*, 2012); *T. dilatatus* sp. nov. 与产自甘肃更新统的 *T. muscorum* Linné, 1943 口部均无齿, 不同的是新种壳体更微小 (余汶等, 1963)。

**产地层位** 缅甸北部; 上 Albian 阶—下 Cenomanian 阶。

## 4 讨 论

倍唇螺科 (Diplommatinidae) 化石记录匮乏, 产自缅甸琥珀的 *Euthema naggsi* Yu, Wang and Pan, 2018 是该科的最早化石记录, 本文描述的该种新标本丰富了倍唇螺科的化石记录。*Truncatellina* 属化石记录集中在新生代地层, 如 *T. lentilii* Miller, 1900 产自中新世奥地利 Gratkorn 盆地 (Harzhauser *et al.*, 2008), *T. pantherae* Harzhauser and Neubauer, 2014 产自奥地利莱茵河中新世地层 (Harzhauser *et al.*, 2014), ?*Truncatellina* sp. 产自德国西南部中新统 (Salvador *et al.*, 2015), *Truncatellina* cf. *callicratis* Scacchi, 1833 产自中新世意大利西北部一个盆地 (Harzhauser *et al.*, 2015), *T. cylindrica* 产自意大利中部更新世地层 (Marcolini *et al.*, 2003), 中生代地层中尚未发现此属化石, 因此白垩纪中期缅甸琥珀中的记录是 *Truncatellina* 属在东南亚中生代地层中首次发现, *Truncatellina dilatatus* sp. nov. 也是旋螺科最老化石记录, 将其最早记录至少提前 70 Ma。

利用腹足动物来研究古生态和古环境, 最大优势是可以借助现生腹足类的生态和生活环境来分析其古生态和古环境的特性。旋螺科的大部分属种栖息于温度适宜的湿地环境, 如沼泽或芦苇荡湿地 (Książkiewicz *et al.*, 2013), *Truncatellina* 一般生活于多石灰岩地区, 栖息在多苔藓、地衣的石灰岩壁上或者湿润的草甸 (Salvador *et al.*,

2016)。现生 *Truncatellina* 主要分布于 Palearctic 区 (古北区: 包括欧洲、亚洲北部、阿拉伯北部以及非洲的撒哈拉以北部分) 和 Afrotropic 区 (非洲南部的撒哈拉沙漠, 南部和东部边缘的阿拉伯半岛, 马达加斯加岛, 南部的伊朗和极端西南部的巴基斯坦, 以及西印度洋的岛屿), 少部分属种分布于 Indo-Malayan 区 (印度-马来区) (David *et al.*, 2012)。现生倍唇螺科主要分布于热带区域, 尤其是在东南亚热带雨林地区属种尤为丰富 (Dinarzarde *et al.*, 2018), 与 *Truncatellina* 生态相似, 一般生活于多石灰岩地区, 栖息在多苔藓、地衣的石灰岩壁上, 石缝中, 落叶下, 多腐殖质的环境 (陈元晓等, 2016)。因此, 推测 *Euthema naggsi*, *Truncatellina dilatatus* sp. nov. 与现生类群有相似的栖息环境, 从而进一步印证白垩纪中期缅甸琥珀产区为温暖潮湿的热带雨林气候。

## 5 结 论

本文详细描述白垩纪中期缅甸琥珀中的陆生腹足类新材料: *Euthema naggsi* 与 *Truncatellina dilatatus* sp. nov. 分别是倍唇螺科和旋螺科化石的最早记录。这些新材料的发现不但提高了缅甸琥珀生物群的物种多样性和腹足类化石的属种丰富度, 也进一步印证了白垩纪中期缅甸琥珀产区温暖潮湿的热带雨林气候。

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