

Two new species of *Planoprosopon* (Decapoda: Brachyura: Longodromitidae) from the Torinosu Group (Upper Jurassic–Lower Cretaceous), Shikoku, Japan

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Abstract

Two new species of Longodromitidae, *Planoprosopon ogawaense* and *Planoprosopon sarumaru*, are described, based upon examination of the previously known and new specimens of crabs from the Torinosu Group (Upper Jurassic–Lower Cretaceous), Shikoku, Japan. Both species together with goniodromitids from the Torinosu Group (Karasawa and Kato, 2007) and a longodromitid from the Somanakamura Group (Kato *et al.*, 2010) represent the oldest records of Brachyura known from the circum-Pacific realm.

Key words: Decapoda, Brachyura, Dromiacea, Longodromitidae, Torinosu Group, Late Jurassic–Early Cretaceous, Japan

Introduction

Karasawa and Kato (2007) described three new species of goniodromitids, *Goniodromites hirotai*, *Goniodromites sakawense*, and *Pithonoton iyonofutanajima*, from the Upper Jurassic Torinosu Group of Shikoku, Japan (Fig. 1.4–1.6). At that time, they only figured an unnamed species of *Nodoprosopon* Beurlen, 1928, from the same locality. Subsequently, the species was moved to the longodromitid genus *Planoprosopon* Schweitzer, Feldmann, and Lazăr, 2007 (Schweitzer and Feldmann, 2009b).

The purpose of the present study is to describe a new species of *Planoprosopon* based upon examination of previously known specimens collected from shale of the Yatsuji Formation (Kano and Jiju, 1995) of the Torinosu Group exposed at Ogawa (Karasawa and Kato, 2007), Sakawa-cho, Kochi Prefecture (33°29'18"N; 133°14'18"E). Another new species of *Planoprosopon* is described herein from shale of the Yatsuji Formation of the Torinosu Group distributed in Yoshidayashiki, Sakawa-cho, Kochi Prefecture (33°29'26"N; 133°17'37"E). Although index fossils have not yet been recorded from the crab-bearing localities, Karasawa and Kato (2007) noted that the age of the Yatsuji Formation is middle Tithonian based upon the strontium isotopic data of

Shiraishi *et al.* (2005). More recently, Kakizaki *et al.* (2012) suggested, using strontium isotopic stratigraphy in age, that the Torinosu Group was 151.1 Ma (latest Kimmeridgian) to 140.3 Ma (latest Berriasian). Kobayashi and Wernli (2013) provided the detailed information on the geological age of the Torinosu Group.

Institutional abbreviations

MFM: Mizunami Fossil Museum, Yamanouchi, Akeyo, Mizunami, Gifu, Japan

SGM: Sakawa Geology Museum, Sakawa-cho, Kochi, Japan

Systematics

Section Dromiacea de Haan, 1833

Superfamily Homolodromioidea Alcock, 1900

Family Longodromitidae Schweitzer and Feldmann, 2009a

Genus *Planoprosopon* Schweitzer, Feldmann, and Lazăr, 2007

Type species: *Prosopon heydeni* von Meyer, 1857, by original designation.

Included species: *Planoprosopon aequus* (von Meyer, 1857); *P. conspicuus* Schweitzer, Lazăr, Feldmann,

Stoica, and Franțescu, 2017; *P. cornutus* (Wehner, 1988); *P. dumosus* (Wehner, 1988); *P. heydeni*; *P. hystricosus* Schweitzer and Feldmann, 2009b; *P. kashimaensis* Kato, Takahashi, and Taira, 2010; *P. major* (Hée, 1924); *P. ogawaense*, new species; *P. quadratum* Schweigert and Koppka, 2011; *P. rathamingus* Schweitzer and Feldmann, 2009b; *P. sarumaru*, new species; *P. schweigerti* Schweitzer and Feldmann, 2009c.

***Planoprosopon ogawaense*, new species**

(Fig. 1.1a–1.2)

Nodoprosopon sp.; Karasawa and Kato, 2007, p. 65, fig. 1a–1c.

Planoprosopon sp.; Schweitzer and Feldmann, 2009b, p. 10.

Etymology: The trivial name is derived from “Ogawa”, the village name in a modern history age.

Diagnosis: Small-sized *Planoprosopon*; carapace subpentagonal, longer than wide, widest at about outer orbital angle, weakly vaulted transversely and longitudinally; fronto-orbital width as long as maximum carapace width; rostrum protruded anteriorly, deeply sulcate axially, with broad, V-shaped anterior margin; upper orbital margin gently concave with small, broadly triangular inner orbital spine; outer orbital spine acutely triangular, directed anterolaterally; lateral margins sinuous, diverged posterior to metabranchial area, with deep cervical and branchiocardiac incisions; posterior margin wide, axially concave, rimmed; dorsal surface densely granulated; cervical groove deep, sinuous, slightly directed obliquely toward axial region; branchiocardiac groove deepest laterally, nearly straight, directed obliquely posteriorly; postcervical groove deep, connected laterally with branchiocardiac groove; epibranchial regions well inflated.

Description: Small-sized *Planoprosopon*. Carapace subpentagonal, longer than wide, maximum width including rostrum about 90 percent maximum length, widest at about outer orbital angle, weakly vaulted transversely and longitudinally. Fronto-orbital width about as long as maximum carapace width. Rostrum protruded anteriorly, slightly wider than long at base, deeply sulcate axially; anterior margin broad, V-shaped; lateral margins flared. Orbit wide, shallow, directed forward. Upper orbital margin gently concave, directed obliquely posteriorly toward lateral margin, with small, broadly triangular inner orbital spine directed anterolaterally; outer orbital spine well developed, acutely triangular, directed anterolaterally. Lateral margins sinuous, diverged posterior to metabranchial area, with deep cervical and branchiocardiac incisions. Posterior margin wide, slightly narrower than fronto-

orbital margin, axially concave, rimmed. Dorsal surface densely granulated; regions more or less defined. Protogastric regions weakly inflated. Mesogastric region widened posteriorly, with long anterior process extending to base of rostrum. Hepatic regions weakly inflated. Cervical groove continuous, deep, sinuous; lateral elements nearly straight, slightly directed obliquely toward metagastric region; axial element moderately concave forward. Branchiocardiac groove deepest laterally, nearly straight, directed obliquely posteriorly, weakening axially. Postcervical groove deep, connected laterally with branchiocardiac groove, composed of two elements on each side of axis arched posteriorly and joining with branchiocardiac groove. Metagastric region much wider than long, gently convex, weakly bilobed axially, separated from epibranchial regions by subtle groove. Urogastric region short, narrow, depressed. Epibranchial regions well inflated. Meso- and metabranchial regions confluent, gently convex. Cardiac region wider than long, pentagonal, weakly inflated. Intestinal region narrow, depressed.

Ventral aspects and appendages unknown.

Remarks: The new species is most similar to *Planoprosopon hystricosus* and *P. rathamingus* from the Tithonian Ernstbunn Limestone of Austria (Schweitzer and Feldmann, 2009b) by having a relatively short carapace with well inflated epibranchial regions. However, the new species has the densely granulated carapace and lacks tubercles on the gastric and hepatic regions. Additionally, within the new species lateral margins lack hepatic spines, which both *P. hystricosus* and *P. rathamingus* possess. Schweigert and Koppka (2011) suggested that *P. quadratum* Schweigert and Koppka, 2011, from the Middle Jurassic of Germany bore some resemblance to the present new species (“*Nodoprosopon* sp.” as in Schweigert and Koppka, 2011); a much longer hepatic region distinguished it from *P. quadratum*. *Planoprosopon ogawaense* has densely granular ornamentations of the carapace.

Material examined: SGM1300 (holotype) and SGM1302 (paratype); shale of the Yatsuji Formation of the Torinosu Group (Upper Jurassic–Lower Cretaceous) exposed at Ogawa (Locality of Karasawa and Kato, 2007), Sakawa-cho, Kochi Prefecture (33°29'18"N; 133°14'18"E).

***Planoprosopon sarumaru*, new species**

(Fig. 1.3a–1.3e)

Etymology: The specific name is derived from “Den sarumarudayū no haka”, a historical site of Sakawa-cho near the type locality. Therefore, the name is an

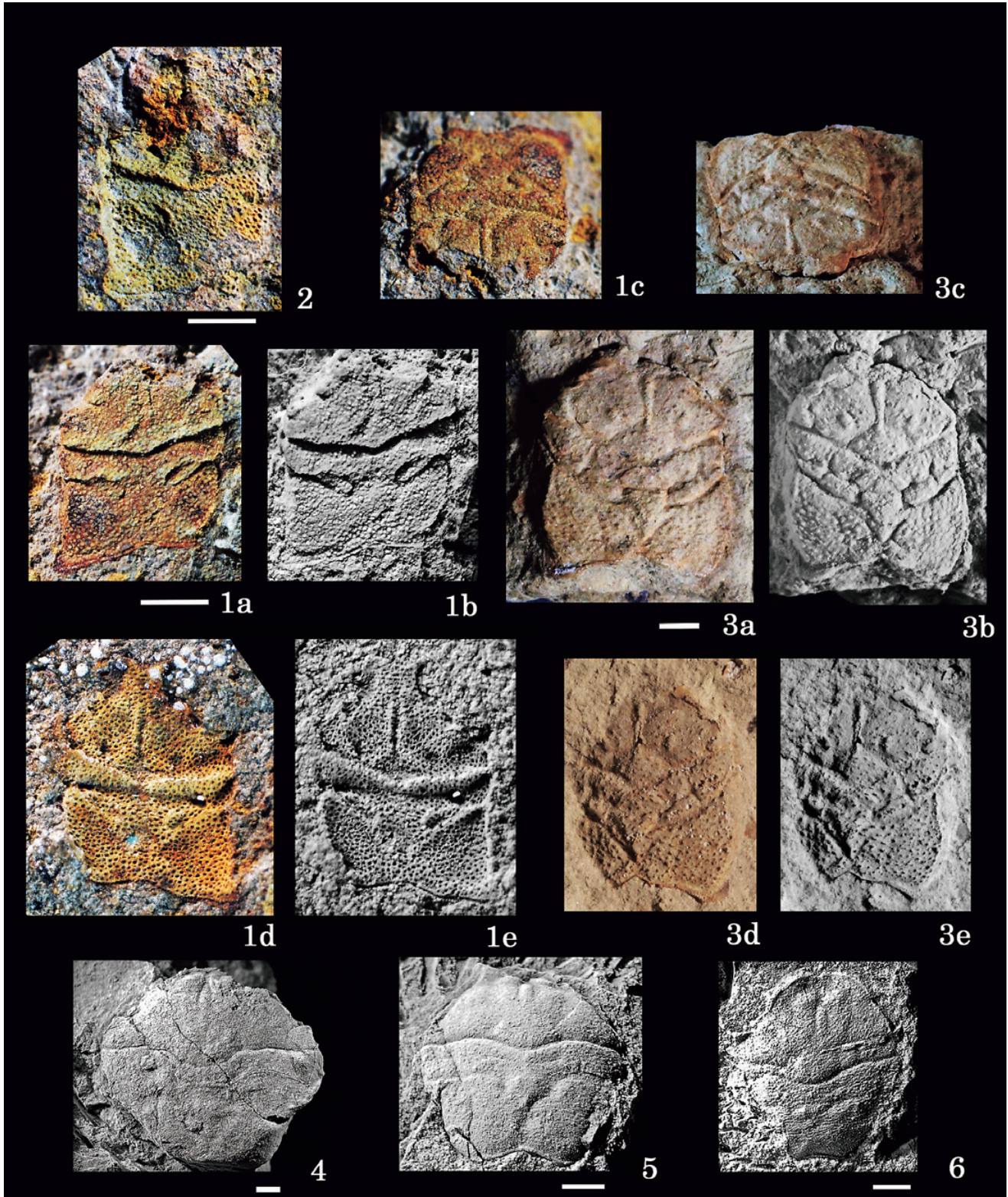


Fig. 1. Crabs from the Torinosu Group (Upper Jurassic–Lower Cretaceous) in Sakawa-cho, Shikoku, Japan. 1a–1e, 2. *Planoprosopon ogawaense*, new species. 1a–1e, holotype (SGM1300), carapace. 1a, 1b, internal mold, dorsal view; 1c, internal mold, oblique-frontal view; 1d, 1e, external mold. 2, paratype (SGM1302), external mold of carapace. 3a–3e. *Planoprosopon sarumaru*, new species. Holotype (SGM1303), carapace. 3a, 3b, internal mold, dorsal view; 3c, internal mold, oblique-frontal view; 3d, 3e, external mold. 4. *Goniodromites hirotai* Karasawa and Kato, 2007, MFM247020, dorsal view of carapace. 5. *Goniodromites sakawense* Karasawa and Kato, 2007, MFM247021, dorsal view of carapace. 6. *Pithonoton iyonofutanajima* Karasawa and Kato, 2007, MFM247022, dorsal view of carapace. Scale bars = 2 mm. 1b, 1e, 3b, 3e, 4, 5, and 6 are whitening images coated with ammonium chloride sublimate.

arbitrary combination of letters.

Diagnosis: Moderate-sized *Planoprosopon*; carapace subrectangular, much longer than wide, widest at about posterior fourth, weakly vaulted longitudinally, nearly flattened transversely; fronto-orbital margin wide with broadly triangular outer orbital angle; lateral margins sinuous, slightly diverged posteriorly, with deep cervical, postcervical, and branchiocardiac incisions; posterior margin concave, rimmed, wide, with broadly triangular axial incision; dorsal surface densely covered with small spines; regions well defined; protogastric regions with protuberance posteriorly; hepatic regions with small protuberance; cervical groove continuous, deep, moderately concave forward, directed obliquely toward axial region; branchiocardiac and postcervical grooves deep; epibranchial regions flattened, composed of three regions; intestinal region short.

Description: Moderate-sized *Planoprosopon*. Carapace subrectangular, longer than wide, maximum width excluding rostrum about 80 percent maximum length, widest at about posterior fourth, weakly vaulted longitudinally, nearly flattened transversely. Rostrum broken. Fronto-orbital width about 85 percent maximum carapace width. Upper orbital margin wide, sinuous, directed obliquely posteriorly toward lateral margin; outer orbital angle broadly triangular, directed laterally. Lateral margins sinuous, slightly diverged posteriorly, with deep cervical, postcervical, and branchiocardiac incisions; margins behind branchiocardiac incision gently convex; posterolateral angle widely rimmed. Posterior margin concave, rimmed, wide, about 85 percent maximum carapace width, with broadly triangular axial incision. Dorsal surface densely covered with small spines; regions well defined. Protogastric regions weakly inflated with protuberance posteriorly. Mesogastric region widened posteriorly; anterior process long, well raised, narrowing posteriorly. Hepatic regions bearing small protuberance, separated from protogastric regions by weak depression. Cervical groove continuous, deep, moderately concave forward, directed obliquely toward axial region. Branchiocardiac groove deep, nearly straight, directed obliquely posteriorly, weakening axially. Postcervical groove deep, composed of two elements on each side of axis arched posteriorly and connected with branchiocardiac groove; lateral element nearly parallel to branchiocardiac groove. Metagastric region much wider than mesogastric region, gently convex longitudinally, weakly bilobed axially, separated laterally from epibranchial regions by arcuate groove. Urogastric region depressed, only developed as groove. Epibranchial regions flattened, divided into three by postcervical groove

and oblique groove extending from posterolateral corner of metagastric region. Meso- and metabranchial regions confluent, gently convex. Cardiac region inverted triangular, about as long as wide, weakly inflated. Intestinal region short, narrow, depressed.

Ventral aspects and appendages unknown.

Remarks: *Planoprosopon sarumaru* possesses carapace characters most like those of *P. conspicuus* from the Topalu Member (?upper Oxfordian–lower Kimmeridgian) of Romania (Schweitzer *et al.*, 2017), but differs in that the outer orbital angle is broadly triangular, the cardiac region lacks a posterior tubercle, and the posterior margin bears a broadly triangular axial incision. Additionally, the intestinal region in the new species is much shorter than that in *P. conspicuus*.

Material examined: SGM13003 (holotype); shale of the Yatsuji Formation of the Torinosu Group (Upper Jurassic–Lower Cretaceous) exposed at Yoshidayashiki, Sakawa-cho, Kochi Prefecture (33°29'26"N; 133°17'37"E).

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References

- Alcock, A. 1900. Materials for a carcinological fauna of India, 5: The Brachyura Primigenia or Dromiacea. *Journal of the Asiatic Society of Bengal* 68: 123–169.
- Beurlen, K. 1928. Die fossilen Dromiaceen und ihre Stammesgeschichte. *Paläontologische Zeitschrift* 10: 144–183.
- Haan, W. de. 1833–1850. Crustacea. In: Siebold, P. F. von, *Fauna Japonica sive Descriptio Animalium, Quae in Itinere per Japoniam, Jussu et Auspiciis Superiorum, qui Summum in India Batava Imperium Tenent, Suscepto, Annis 1823–1830 Collegit, Noitis, Observationibus et Adumbrationibus Illustravit*. Leiden, Lugduni-Batavorum: i–xvii, i–xxx, ix–xvi, 1–243, plates A–J, L–Q, 1–55.
- Hée, A. 1924. Catalogue critique des Crustacés jurassiques du Calvados et de l'Orne. *Bulletin de la Société Linéenne de Normandie* 6: 126–157.
- Kakizaki, Y., T. Ishikawa, K. Nagaishi, M. Tanimizu, T. Hasegawa, T., and A. Kano. 2012. Strontium isotope ages of the Torinosu-type limestones (latest Jurassic to earliest Cretaceous, Japan): Implication for biocalcification event in northwestern Palaeo-Pacific. *Journal of Asian*

- Earth Sciences 46: 140–149.
- Kano, A., and K. Jiju. 1995. The Upper Jurassic–Lower Cretaceous carbonate–terrigenous succession and the development of a carbonate mound in western Shikoku, Japan. *Sedimentary Geology* 99: 165–178.
- Karasawa, H., and Kato, H. 2007. New prosopid crabs (Crustacea, Decapoda, Brachyura) from the Upper Jurassic Torinosu Group, Shikoku, Japan. *Memorie della Società italiana di Scienze naturali e del Museo civico di Storia naturale in Milano* 35: 62–65.
- Kato, H., T. Takahashi, and M. Taira. 2010. Late Jurassic decapod crustaceans from northeast Japan. *Palaeontology* 53: 761–770.
- Kobayashi, F., and R. Wernli. 2013. Latest Jurassic to earlier Early Cretaceous foraminifers from the Torinosu-type limestone blocks in Southwest Japan: Constraints on chronologic calibration of the Torinosu-type limestones. *The Journal of the Geological Society of Japan* 119: 25–38.
- Meyer, H. von. 1857. Briefliche Mitteilungen. *Neues Jahrbuch für Mineralogie, Geognosie, Geologie und Petrefaktenkunde* 1857: 556.
- Schweigert, G., and J. Koppka, J. 2011. Decapods (Crustacea: Brachyura) from the Jurassic of Germany and Lithuania, with descriptions of new species of *Planoprosopon* and *Tanidromites*. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen* 260: 221–235.
- Schweitzer, C. E., and R. M. Feldmann. 2009a. Revision of the Prosopinae *sensu* Glaessner, 1969 (Crustacea: Decapoda: Brachyura) including four new families, four new genera, and five new species. *Annalen des Naturhistorischen Museums in Wien, Serie A* 110 [for 2008]: 55–121.
- Schweitzer, C. E., and R. M. Feldmann. 2009b. New species of Longodromitidae Schweitzer and Feldmann, 2009, from the Ernstbrunn Formation, Late Jurassic (Tithonian), Austria. *Annalen des Naturhistorischen Museums in Wien, Serie A* 111: 207–224.
- Schweitzer, C. E., and R. M. Feldmann. 2009c. Revision of *Gabriella* Collins *et al.*, 2006 (Decapoda: Brachyura: Homolodromioidea: Tanidromitidae) with new Jurassic species. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen* 252: 1–16.
- Schweitzer, C. E., R. M. Feldmann, and I. Lazăr. 2007. Decapods from Jurassic (Oxfordian) sponge reefs of Dobrogea, Romania and reconsideration of *Nodoprosopon* Beurlen, 1928. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen* 244: 99–114.
- Schweitzer, C. E., I. Lazăr, R. M. Feldmann, M. Stoica, and O. D. Fraşescu. 2017. Decapoda (Anomura: Brachyura) from the Late Jurassic of Dobrogea, Romania. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen* 286: 207–228.
- Shiraishi, S., Y. Hayasaka, Y. Takahashi, M. Tanimizu, T. Ishikawa, J. Matsuoka, M. Murayama, and A. Kano. 2005. Strontium isotopic age of the Torinosu Limestone in Niyodo Village, Kochi Prefecture, SW Japan. *The Journal of the Geological Society of Japan* 111: 610–623.
- Wehner, G. 1988. Über die Prosoponiden (Crustacea, Decapoda) des Jura. Dissertation zur Erlangung des Doktorgrades der Fakultät für Geowissenschaften der Ludwig-Maximilians-Universität zu München. München: 1–154.

Appendix 和文概要

四国の鳥巢層群（上部ジュラ系－下部白亜系）産 *Planoprosopon* 属（十脚目：短尾下目） の 2 新種

柄沢 宏明・廣田 隆吉

高知県佐川町に分布する鳥巢層群（上部ジュラ系－下部白亜系）から産したナガカイカムリ科（新称）Longodromitidae に所属するヒラナガカイカムリ属（新称）*Planoprosopon* の 2 新種を記載した。オガワヒラナガカイカムリ（新称）*Planoprosopon ogawaense* は、甲は小型、頸溝及び鰓心溝が深く、良く膨れた前鰓域を持つ。一方、サルマルヒラナガカイカムリ（新称）*Planoprosopon sarumaru* は、甲は中型、甲背面は平たく、前鰓域が三分され、極端に短い肝域を持つ。ヒラナガカイカムリ属は、ジュラ紀中期～ジュラ紀後期の西部テチス地域から化石種が良く知られ、環太平洋域では鳥巢層群の他、福島県の上部ジュラ系相馬中村層群（Kato *et al.*, 2010）から化石記録が知られるのみである。