

Akihiko SUZUKI¹ : A beach cobble bearing trace fossils of *Caulostrepsis* washed ashore on Morai coast in Ishikari City, Hokkaido

鈴木明彦¹ : 北海道石狩市望来海岸の打ち上げ礫にみられた生痕化石 *Caulostrepsis*

Introduction *Caulostrepsis* is a pouch-shaped boring in a U-bend gallery formed by a polychaete boring in hard substrates (Bromley 1978; Taylor and Wilson 1989; Suzuki 2006). The systematics of this ichnotaxon has been extensively revised and several ichnospecies have been recognized (Bromley and D'Alessandro 1983; Pickerill et al. 1998, 2002).

In June 2012, a beach cobble bearing the ichnogenus *Caulostrepsis* was discovered on the Morai coast near Ishikari City, Hokkaido. In this paper, I briefly describe the characteristics and the paleoecological significance of *Caulostrepsis* and associated molluscan fossils. In addition, the relationship between *Caulostrepsis* ichnofossils and the characteristics of the paleoenvironment is considered.

Materials and methods Abundant molluscan fossils were discovered in the Morai Formation in a coastal cliff at Morai, Ishikari City, in central Hokkaido (Fig. 1). The Morai Formation consists of alternating beds of hard shale and mudstone with many calcareous concretions, and has been assigned to the Late Miocene based on diatom fossils (Kakimi 1958).

Calcareous concretions associated with flotsam that had washed ashore were collected on 12 June 2012 (Fig. 2A). The cobble bearing the trace fossil was identified based on comparisons with ichnological literature (Bromley and D'Alessandro 1983; Bromley 1994). Geological characteristics, such as the paleoenvironment and taphonomy, were inferred based on previous studies (Bromley and D'Alessandro 1983; Pickerill et al. 1998, 2002).

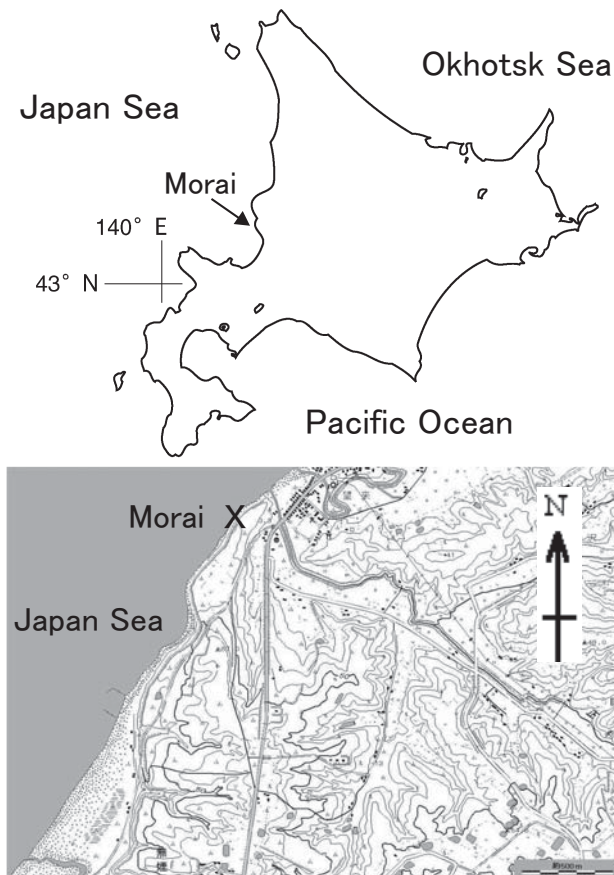


Fig.1 Map showing the location of the Morai coast in Ishikari City, Hokkaido.
X: Sample locality.

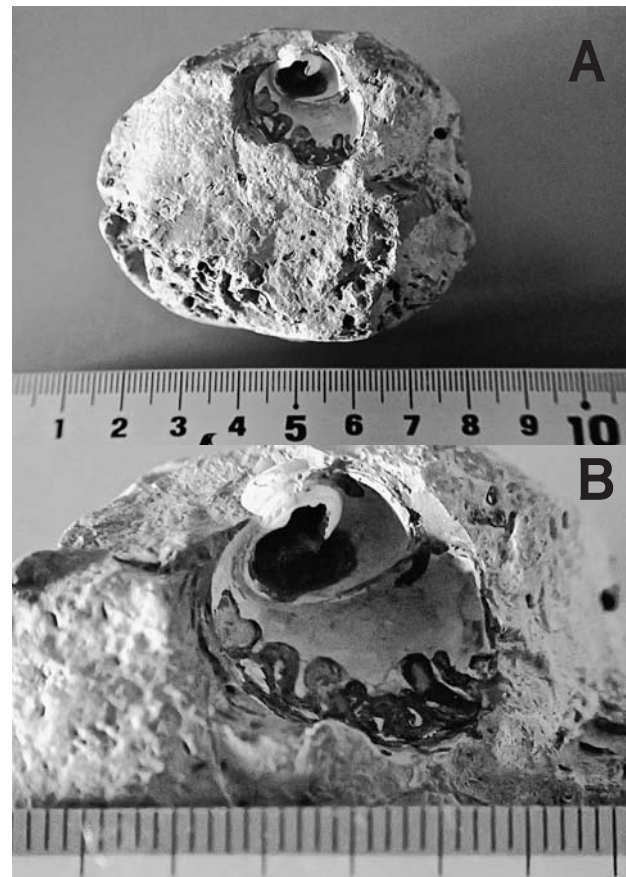


Fig.2 *Caulostrepsis* isp. washed up on Morai coast.
A. A cobble bearing *Caulostrepsis* isp.
B. Close-up of *Caulostrepsis* isp.

Results and discussion The cobble specimen that washed up on the Morai coast measured $72.2 \times 65.3 \times 60.4$ mm (Fig. 2A). The cobble was a dark-grey calcareous concretion including a Giant Cleftclam (*Conchocele bisecta*), a Buccinid gastropod, and shell fragments. Many pouch-shaped borings were observed on the inner surface of the Buccinid gastropod, one of which was examined in detail (Fig. 2B). Smooth, horizontal, U-bend gallery with individual limbs separated by distinct and well-developed structureless central vane, the latter narrowing aperturally. Limb width consistently ca. 1 mm, maximum vane width 3 mm, gradually diminishing aperturally with an overall length of 10 mm. Apertural openings absent. These descriptions follow the morphological terminology of Bromley and D'Alessandro (1983). The borings described here were identified as belonging to the ichnotaxon *Caulostrepsis* isp.

On this coast, numerous calcareous concretions containing *Conchocele bisecta* and *Calyptogena pacifica* in association with *Acharax tokunagai* are washed ashore (Suzuki et al. 2014). The species composition of these assemblages is similar to that of modern cold seep communities from Monterey Bay, California (Barry et al. 1996). Based upon the depth range of extant species overlap, a fossil cold seep community may have existed on the lower shelf at Morai (Suzuki et al. 2014).

Further, the abundance of cold seep community fossils appears to be closely related to an extant cold seep community in the deep-sea area off Morai (Barry et al. 1996). Thus, the presence of molluscan fossils, the high density of the *Caulostrepsis*, and the sediments associated with the *Caulostrepsis* are all considered to indicate the presence of a cold seep on the lower shelf during the Middle Miocene (Suzuki et al. 2014).

Acknowledgments This study was supported by a Grant-in-Aid for Scientific Research from the Japan Society for the Promotion of Science (C 25350224).

要約：2012年6月、北海道石狩市望来海岸において、生痕化石を含む打ち上げ礫を採集した。この礫は、海岸を構成する望来層（新第三紀中新世後期）に由来する石灰質団球である。礫に含まれていたのは、化石貝殻に穿孔した生痕化石 *Caulostrepsis* isp. であることが判明した。*Caulostrepsis* isp. は多毛類による穿孔痕で、随伴化石から化学合成群集の卓越する海底で形成されたと考えた。

References

- Barry, J. P., Green H. G., Orange D. L., Baxter C. H., Robinson B. H., Kochevar R. E. Nybakken J. W., Reed D. L. and McHugh, C. M. 1996. Biologic and geologic characteristics of cold seeps in Monterey Bay, California. *Deep-Sea Research (I)* **43**: 1739-1762.
- Bromley, R. G. 1978. Bioerosion of Bermuda reefs. *Palaeogeogr. Palaeoclimatol. Palaeoecol.*, **23**: 169-197.
- Bromley, R. G. 1994. The paleoecology of bioerosion. In: Donovan, S. K. (ed.), *The Palaeobiology of Trace Fossils*, John Wiley and Sons, Chichester, 134-154.
- Bromley, R. G. and D'Alessandro, A. 1983. Bioerosion in the Pleistocene of southern Italy: ichnogenera *Caulostrepsis* and *Maeandropolydora*. *Rivista di Paleontologia e Stratigrafia*, **89**: 289-309.
- Kakimi, T. 1958. Geology of the Ishikari district. Quadrangle Series, 1:50,000, Geological Survey of Japan, 47pp. (in Japanese with English abstract)
- Pickerrill, R. K., Donovan, S. K. and Mitchell, S. F. 1998. Ichnology of the Late Pleistocene Port Morant Formation of southeastern Jamaica. *Caribbean Journal of Science* **34**: 12-32.
- Pickerrill, R. K., Donovan, S. K. and Portell, R. W. 2002. Bioerosional trace fossil from the Miocene of Carriacou, Lesser Antilles. *Caribbean Journal of Science* **38**: 106-117.
- Suzuki, A. 2006. Bioerosion of coastal driftages on the coast of Ishikari Bay, Hokkaido. *Journal of Japan Driftological Society* **4**: 1-7. (in Japanese with English abstract)
- Suzuki, A., Shiga, K., Enya, T., Nomura, N. and Okamura, S. 2014. Significance of beachcombing and fossil collection for geoscience education on coastal geosites: A case study of the Ishikari Ecomuseum Area, Hokkaido, Japan. *Atlantic Geology*, **50**: 265-266.
- Taylor, P. D. and Wilson, M. A. 1989. Palaeoecology and evolution of marine hard substrate communities. *Earth-Science Reviews*, **62**: 1-103.

(Received Mar. 25, 2016; accepted May 25, 2016)

¹北海道教育大学札幌校地学研究室 〒002-8502 札幌市北区あいの里5-3-1

¹Department of Earth Science, Sapporo Campus, Hokkaido University of Education, 5-3-1 Ainosato, Kita-ku, Sapporo 002-8502, Japan