Bull. Mizunami Fossil Mus., no. 23 (1996), p. 29-33, 2 figs., 1 tab.

Status of *Cardium* (*Laevicardium*) *tristiculum* Yokoyama (Bivalvia, Cardiidae)

Alexander I. Kafanov* and Kazutaka Amano**

*Institute of Marine Biology, Far East Branch of the Russian Academy of Sciences, Vladivostok 690041, Russia
**Department of Geoscience, Joetsu University of Education, Joetsu, Niigata Prefecture 943, Japan

Abstract

Cardium (*Laevicardium*) *tristiculum* Yokoyama, 1924 from the Oligocene Asagai Formation can be distinctly discriminated from the Maoka species in Sakhalin described as the former species by Yokoyama (1930). The latter species was named as *Nemocardium yokoyamai* by Takeda (1953). Moreover, *Nemocardium karaftoense* Krishtofovich, 1954 is a junior synonym of *N. yokoyamai*. The Asagai species should not be included in *Nemocardium*, but tentatively in *Laevicardium*. *Laevicardium* (*Cerastoderma*) *esutoruensis* Krishtofovich, 1954 is a junior synonym of *L. tristiculum*. Consequently, *Laevicardium tristiculum* (Yokoyama) has been reported from the Oligocene formations in Honshu and Sakhalin.

Introduction

Cardium (*Laevicardium*) *tristiculum* was established by Yokoyama (1924), based on the specimens from the Oligocene Asagai Formation in Fukushima Prefecture. Thereafter, Yokoyama (1930) has described the same species from the Oligocene Maoka Group in South Sakhalin. However, as this species includes two different forms, some taxonomical problems were occurred. In this paper, we taxonomicaly revise the status of this species and discuss the biostratigraphical significance of this species.

Notes on the taxonomy

When Yokoyama (1924) proposed *Cardium* (*Laevicardium*) *tristiculum* as a new species, he did not assigned any types among his illustrated specimens (p. 16, pl. 3, figs. 5,6,7). The lectotype of this species was designated by Hatai and Nisiyama (1952, p. 42). They designated the specimen illustrated in pl. 3, fig. 7 of Yokoyama (1924) as "holotype". However, this lectotype distinctly differs from the specimens (Yokoyama, 1930, p. 415, pl. 78, figs. 3-6) from "a dark greenish grey hard sandstone of Shiromizu Hot Spring" in South Sakhalin [presently near Teplovodsky and Klyuchi Villages, Yuzhuno-Sakhalinsk District; Maoka Group of Uwatoko (1937) = Takaradaiskaya or Arakaiskaya Suite by Russian authors].

Concerning the Sakhalin specimens, there is no doubt in their belonging to the genus *Nemocardium* Meek, 1876 because of having a well defined umbonal ridge and sometimes weakly spinose radial ribs. The following two independent species have been established from the same Yokoyama's South Sakhalin specimens:

Nemocardium yokoyamai Takeda, 1953, p. 84 pl. 9, figs. 10-12 ; pl. 11, fig. 4 : Type locality, Shiromizu Hot Spring, Kawakami-mura, Toyohara-gun, South

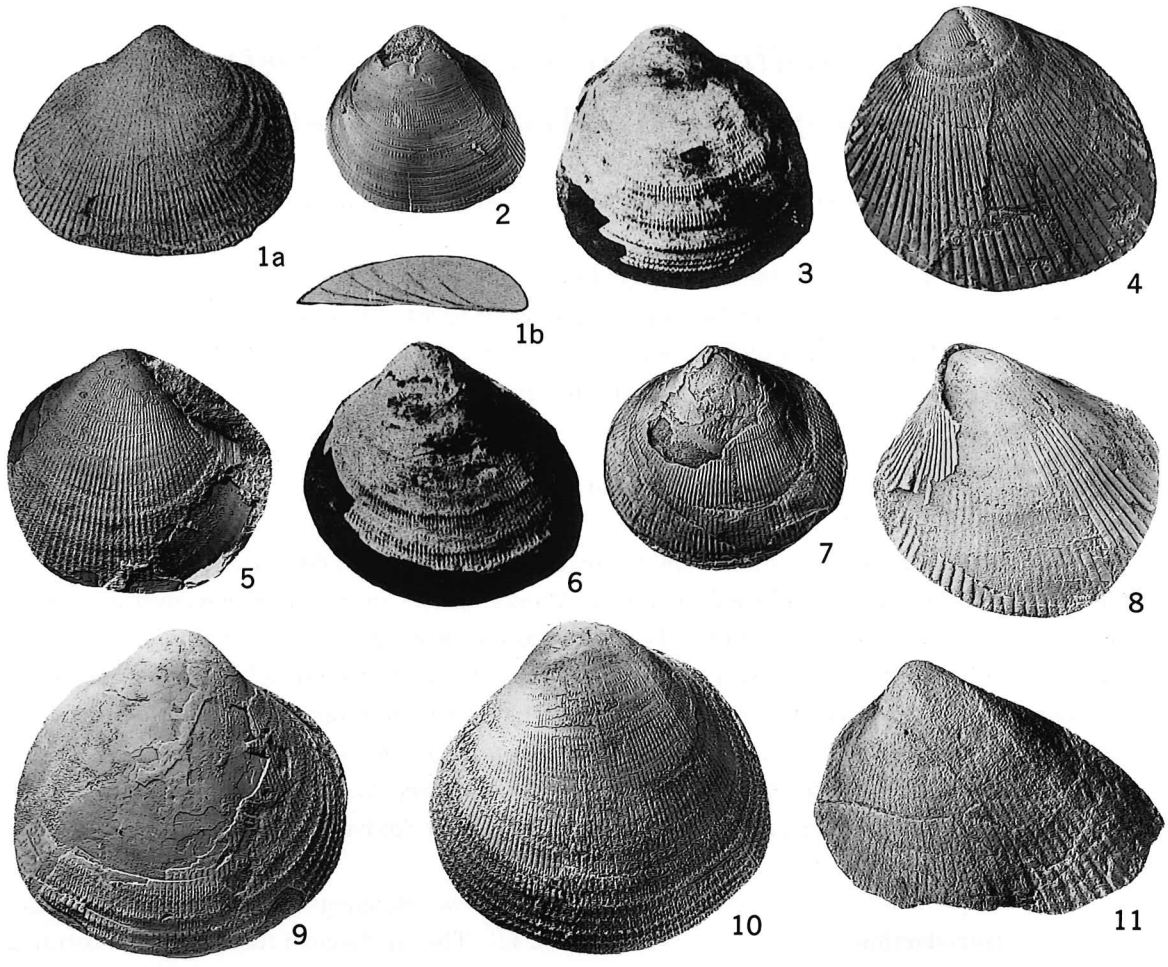


Fig. 1. *Laevicardium tristiculum* (Yokoyama) and *Nemocardium yokoyamai* Takeda (all in natural size). 1, 4, 8, 11. *Laevicardium tristiculum* (Yokoyama). 1a-b. Lectotype, UMUT no. CM22087, reproduced from Yokoyama (1924, pl. 3, fig. 7), Asagai Formation. 4. Paralectotype of *Laevicardium* (*Cerastoderma*) *esutoruensis* Krishtofovich, CNIGR Museum no. 91/6818, Makarova (Shiritori) River, Makarov Dsitrict, basal part of the Kholmskaya Suite. 8. PIN no. 57/3962, Uglegorsk River, Uglegorsk District, upper member of the Arakaiskaya Suite. 11. PIN no. 68/3962, Makarova River, Makarov District, upper member of the Gastellovskaya Suite. 2-3, 5-7, 9-10. *Nemocardium yokoyamai* Takeda. 2. Paralectotype of *Nemocardium karaftoense* Krishtofovich, CNIGR Museum no. 101/6818, Ikenohata [now near Kamyshevo Village], Kholmsk District, Takaradaiskaya Suite. 3. Paralectotype, UMUT no. CM25703, reproduced from Yokoyama (1930, pl. 78, fig. 6). 5. VNIGRI no. 137/825, Gornaya River, Makarov District, lower member of Gastellovskaya Suite. 6. Lectotype, UMUT no. CM25702, reproduced from Yokoyama (1930, pl. 78, fig. 5), Maoka Group [Takaradaiskaya or Arakaiskaya Suite]. 7. Paralectotype of *Nemocardium karaftoense* Krishtofovich, CNIGR Museum no. 102/6818, upstream of Chekhovka (Noda) River, Kholmsk District, Takaradaiskaya Suite. 9, 10. PIN no. 70/3962, Romanai [now Luzhki], Nevel'sk District, Takaradaiskaya Suite.

Sakhalin: Lectotype (Yokoyama, 1930, pl. 78, fig. 5 ; designated by Oyama *et al.*, 1960, p. 175, pl. 66, fig. 6a.) at Department of Historical Geology and Paleontology of the University Museum, University of Tokyo (UMUT) no. CM 25702 (Ichikawa, 1983 ; Fig. 1-6) : Paralectotypes also there, nos. CM 25700, CM 25701 and CM 25703.

Nemocardium karaftoense Krishtofovich, 1954 [1957], p. 94, pl. 17, figs. 1,1a, 2,2a, 3,4-8 : Type locality, Ikenohata [presently near Kamyshevo Village, Kholmsk District, South Sakhalin: Takaradaiskaya Suite, Layer with *Nemocardium karaftoense*: Lectotype (Krishtofovich, 1954, pl. 17, fig. 4 ; designated herein) at Central Reserch Geological Exploration Museum (CNIGR Museum), St. Petersburg no. 98/6818 : Paralectotypes also there, nos. 95/6818, 97/6818, 99/6818, 100/6818, 101/6818 and 102/6818 (Fig. 1-2,7).

Among the above two species, *Nemocardium yokoyamai* is available because the name of *N. karaftoense* was preoccupied by the first species.

The lectotype of *Cardium* (*Laevicardium*) *tristiculum* deposited in UMUT as CM no. 22087 was occurred from the Asagai "Miocene" (= Oligocene) near the Asaka coal-mine, Numanosaku, Yamadaoka-mura, Futaba-gun, Fukushima Prefecture. Hatai and Nisiyama (1952, p. 42) and Oyama *et al.* (1960, p. 176, pl. 54, figs. 1a, b) considered this lectotype as a species of *Nemocardium*. Moreover, Kamada (1962, p. 101) pointed out the similarity between this lectotype and *Nemocardium iwakiense* (Makiyama, 1934). However, according to the original description and Yokoyama's figure (Fig. 1-1), there is no ground to refer it to *Nemocardium*, but tentatively to *Laevicardium* Swainson, 1840.

Laevicardium (*Cerastoderma*) *esutoruensis* (Fig. 1-4) was established by Krishtofovich (1954, p. 93, pl. 16, figs. 4, 5, 6, 6a, 8, 13) from the correlative layer with the lower part of Arakaiskaya Suite (Layer with *Cardium estoruensis*) along the Esutoru (present Lesogorsk) River near Solntsevo Village, Uglegorsk District, Southwest Sakhalin. The lectotype of this species is herein designated for the specimen illustrated in Krishtofovich (1954, pl. 16, fig. 4 ; CNIGR Museum no. 88/6818). By personal communication from Dr. L. Krishtofovich, the fragment of the external surface of the valve illustrated in pl. 16, fig. 6a is badly distorted by retouching. As a result of examination, *Laevicardium* (*Cerastoderma*) *esutoruensis* can be identified with *Cardium* (*Laevicardium*) *tristiculum* because of its similar shell shape, size and similar number (45-62 ; *C. tristiculum*, up to 60 in the original description) of radial ribs. Therefore, the formeris considered as a synonym of the latter.

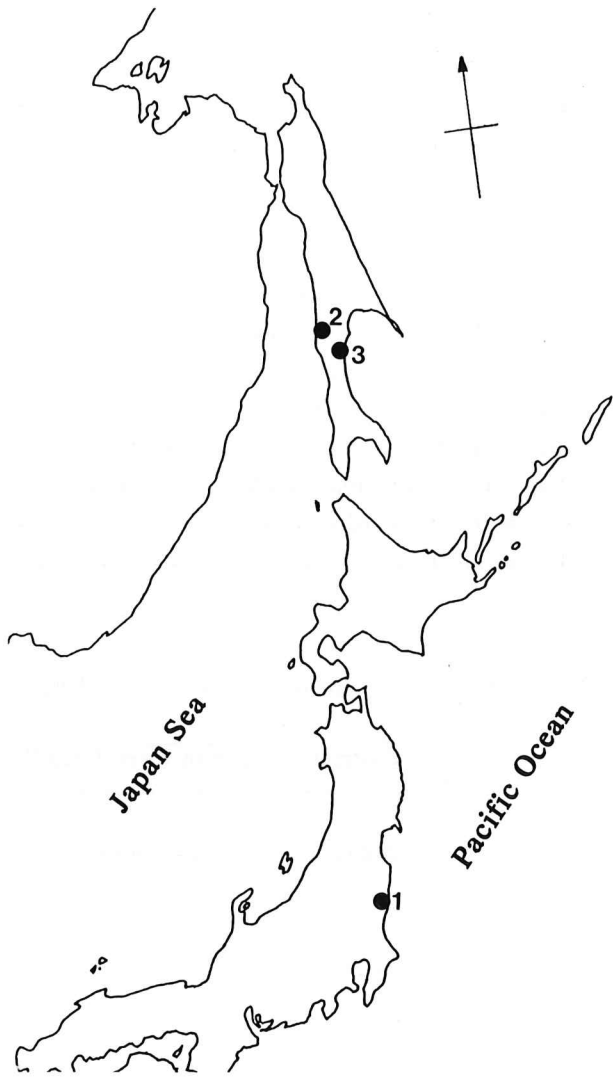


Fig. 2. Geographical distribution of *Laevicardium tristiculum* (Yokoyama). 1. Joban Coal-field. 2. Uglegorsk District. 3. Makarov District.

Biostratigraphic significance

The faunistic horizon of *Laevicardium tristiculum* (Yokoyama, 1924) (=*L. estoruensis*) has been established as a marker of the Arakaiskaya Suite and its correlatives by Krishtofovich (1954) and by Margulis and Savizky (1969). As a result of this study, it has become clear that the present species was occurred only from the Oligocene formations in central Honshu and Sakhalin (Fig. 2).

In Joban Coal-field of cenral Honshu, the Asagai Formation yields this species. According to Yanagisawa *et al.*(1989), the age of the Shiramizu Group including the Asagai Formation was assigned to Early Oligocene by diatom flora, molluscs and mammal fossils (Table 1).

In Uglegorsk district of southwestern Sakhalin, this species has been found from the upper member of Arakaiskaya Suite (Krishtofovich, 1954, 1964). Okamura (1994) assigned an age of 38.6Ma and 30.6 Ma to the lower and middle parts of the Arakaiskaya Suite by K-Ar dating method.

In Makarov district of southeastern Sakhalin, from the Gastellovskaya and Kholmskaya Suites, the species has been recorded by Kafanov and Savitsky (1983) and Arkhipova *et al.* (1992). Recently, these suites were correlated with the Oligocene formations in eastern Hokkaido by the dinoflagellate fossils (Kurita *et al.*, 1996).

Judging from the above data, the occurrence of *Laevicardium tristiculum* is confined to the Early to Late Oligocene in Honshu and Sakhalin. Therefore, this species is also important for correlation of the Paleogene formations in Sakhalin and Japanese Islands.

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Table 1. Stratigraphical distribution of *Laevicardium tristiculum* (Yokoyama). Black circle shows the horizon of this species.

District / Age	Joban Coal-field [1]	Uglegorsk [2) 3)]	Makarov [3)]
		Chekhovskaya S.	
E. Miocene	Yunagaya G.	Nevel'skaya S.	Chekhovskaya S.
----------		Kholmskaya S.	Nevel'skaya S.
			Kholmskaya S.●
L. Oligocene		Arakaiskaya S.●	Gastellovskaya S.●

E. Oligocene	Shiramizu G.●	Takaradaiskaya S.	

[1)]Yanagisawa *et. al.*, 1989, [2)]Okamura, 1994, [3)]Kurita *et al.*, 1996

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***Cardium* (*Laevicardium*) *tristiculum* Yokoyama (二枚貝，ザルガイ科) の分類上の位置**

A. I. Kafanov・天野和孝

要　　旨

Cardium (*Laevicardium*) *tristiculum* はYokoyama (1924) により漸新世浅貝層から記載された．また，Yokoyama (1930) によりサハリンの真岡層群から *Cardium* (*Laevicardium*) *tristiculum* として報告された種は Takeda (1953) により新種 *Nemocardium yokoyamai* として記載されている．浅貝層から産出する種は *Nemocardium* 属には含まれず，*Laevicardium* 属に含まれると考えられる．また，Krishtofovich (1954) により提唱された *Laevicardium* (*Cerastoderma*) *esutoruensis* は *L. tristiculum* の新参シノニムである．結果的に，*Laeveicardium tristiculum* Yokoyama は本州，サハリンの漸新統に産出が限られ，生層序学的に重要な種であると考えられる．