

A Note on the Cross-Sections of *Nereites* from the Eocene Muroto Formation of Kochi Prefecture, Japan

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Introduction and Acknowledgements

The occurrence of many worm-like trace fossils from the Oligocene and Eocene sedimentaries distributed in the seaward area of Kochi Prefecture, Shikoku had already been reported in several papers (Katto, 1959, 1960a, 1960b, 1964). These papers dealt with the worm-like structures from the viewpoint of descriptions, systematics and comparative morphology with known living marine worms. The purpose of those articles was the biostratigraphic additions to the stratigraphic units recognized among the Eocene and Oligocene strata and an attempt to paleoecologic implications of them to the paleosedimentary environment of the sedimentary basin.

In the present article a few remarks will be made on the interpretation of the structures exhibited by several cross-sections made of *Nereites tosaensis* Katto and *Nereites murotoensis* Katto, both from the Paleogene sediments well developed and distributed widely in the Muroto Peninsula in Kochi Prefecture.

Before going into the details, the writer would like to thank Professor Kotora Hatai of the Institute of Geology and Paleontology, Tohoku University, for his kindness concerning this work. Thanks are due to Mr. Kimiji Kumagai of the same Institute for his photographic work and to Mr. Akio Ishikawa for making the thin rock slices of the worm-like specimens.

Remarks on the Cross-Sections of *Nereites*

At first polished surfaces were made of the cross-sections of the best preserved specimens of *Nereites tosaensis* Katto (Figs. 1, 2) and also of *N. murotoensis* Katto (Figs. 3, 4, 5, 6), then thin slices were cut from the opposite sides of the polished surfaces for microscopic examination and photographing. Both polished surface and thin sections were made perpendicular to the longitudinal axis of the preserved impressions. By this procedure the microstructures, if preserved, in the sediments at the time the original marine worm crawled over the soft muds of the sea-bottom, of the sediments deposited over the trails made by the marine worms, and of any internal microstructure of the original worm (?) if preserved, are thought to be observable.

The original impression of both *tosaensis* (Fig. 1) and of *murotoensis* (Figs. 3, 5) are photographed to show what part of the fossil the sections were made, and photomicrographs were made of the thin sections to show the internal microstructures preserved in the sediments of those two fossils.

As well illustrated in the thin section of Fig. 2, and very obscurely in Fig. 6, peculiar internal structures are found in and immediately above the original position of the *Nereites* trail. In Fig. 2 it is noteworthy that the thin laminae that had deposited parallel with

the bedding and in successive layers, was ruptured by some force acting upon them after they had been deposited. The rupturing of the laminae is from below upwards as is seen from the upward turned ruptured portions of the laminae. This upward turning of the laminae decreases in insensity upwards whereas the ruptured nature or explosive-like phenomenon commences from almost at the bottom of the *Nereites* impression and continues upwards to almost the top of the rock-specimen, or nearly twice the height of the original impression.

Considerable contortion of the sediments and the ruptured nature of the laminae all point to that some peculiar phenomén had taken place before consolidation of the sediments and after death of the original worm that had made the impression. This same feature is also shown in Fig. 6, although only obscurely.

The just described feature is here interpreted as follows. After the worm had died *in situ*, it was covered by sediments deposited successively in alternating fashion, resulting in the development of abundant laminae parallel with one another and separated from each other by non-laminated muddy sediments. After the sediments had accumulated to about a little more than twice the thickness of the original marine worm (*Nereites*), the original worm because of death was subjected to decay and the expulsion of gases from the decaying organic matter. The gases escaping upwards through the still soft sediments caused contortion of the sediments through its path to the sea-bottom surface and also rupturing of the laminae.

From the interpretation of the thin-section of the *Nereites* specimen (Figs. 1, 2), it is considered that the impression is not that of the trail of the marine worm, but that of the original worm. This may also be one of the reasons why the impressions are so well preserved.

The thin-section shown in Fig. 4, seems to represent a case different from the ones shown in Figs. 2, 6, in that there is no recognizable contortion or rupturing of the sediments deposited over the original worm at the time of or at least soon after its death. However, there is developed microcross-laminae, which are directional (current from right to left), and presumably resulting from the obstruction of the marine worm after its death.

The microstructures described above are thought have developed as the result of decay and gas developing therefrom of the original marine worm (*Nereites*) and the trail-structure is not a mere impression but one due to death of the original worm. The contortion of the sediments and ruptures of the laminae are inferred to show that before full decay and escaping gases developed at least 25 mm thick sediments were deposited over the worm since its death.

Finally it may be added that impressions and trace fossils should be studied or at least may better be known from observations of their microstructures made available from their sections cut perpendicular to their longer axis.

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PLATE

Figs. 1, 2, 5, 6. *Nereites tosaensis* Katto (Figs. 1, 2) and *N. murotoensis* Katto (Figs. 5, 6).
Showing the impressions and cut thin-slices (for microscopic observation) of the best preserved specimens. Notice the contortion and rupturing of the laminae in Fig. 2. Natural size.
Locality: Fig. 1. Sea coast of Hanezaki, Muroto City, Kochi Prefecture. Muroto Formation. Eocene. Fig. 5. Sea coast of Gyotozaki, Muroto City, Kochi Prefecture.

Figs. 3, 4. *Nereites murotoensis* Katto. Notice the development of the cross-laminations (Fig. 4) developed due to the obstruction of the original marine worm at or immediately after its death, or at the time of burial. Natural size. Locality: Sea coast of Kannoura, Toyo-cho, Aki-gun, Kochi Prefecture. Naharigawa Formation. Eocene.

J. Katto : Cross-Sections of *Nereites*.

