B-10.3 Evaluation of The Holocene Sea-Level Changes and Climatic Changes around The Japan Sea (Final Report)

Contact Person Yoshiki Saito
Senior Research Scientist
Marine Geology Department, Geological Survey of Japan
Higashi 1-1-3, Tsukuba, Ibaraki 305, Japan
Phone +81-298-54-3772, Fax. +81-298-54-3533
E-mail yoshi@gsj.go.jp

Total Budget for FY 1993-1995 27,654,000 Yen (FY 1995; 9,176,000 Yen)

Abstract The relationship between paleo-coastal environment and sea-level changes has been studied using eight borehole samples taken from Mine Bay and Nita Bay of Tsushima Island, Lake Kushu-ko in Rebun Island, Lake Otadomari-numa in Rishiri Island, and Lake Kamo-ko in Sado Island in the Japan Sea. The sedimentary facies and distribution of accumulation rates in Nita Bay and Mine Bay show that intertidal to subtidal zone is a major depositional center during the rise of sea level and this sediment consists of coarser materials with abundant plant fragments. Bay-mouth barriers formed by abundant sediment supply due to coastal erosion and coastal lagoons are characteristics during the rise of sea level in Lake Kushu-ko, Lake Otadomari-numa and Lake Kamo-ko during the sea-level rise. The coastal sedimentary environment of these areas is greatly influenced by the Holocene sea-level changes.

Key Words Sea-level change, Sea-level rise, Holocene, PAGES, Japan Sea, Tsushima Warm Current

1. Introduction

The future sea-level rise mainly caused by global warming is one of serious problems in global changes. It is estimated to be 66 cm (range: 31-110 cm)[1] and 50 cm (25-80 cm)[2] in 2100 higher than the present level. The rise of sea level induces intense coastal erosion, salt intrusion, often flood and submergence in coastal lowlands. It is important to know sea level rises and their influences on coastal environments occurred in past time from the view point of understanding their phenomena, evaluating the sea-level rise, and predicting their influences.

2. Research Objective

The purpose of this study is to evaluate the influence of sea level rise on coastal environments from past sea-level rise occurred in the early Holocene. The rate of sea-level rise during 8-6 ka of

the later stage in early Holocene sea-level rise is almost the same with that of the predicted future sea-level rise in Japan[3]. The coastal area of the Japan Sea is influenced by the Tsushima Warm Current and a sensitive area for climate changes. Therefore three areas were studied for this purpose, that is Nita Bay and Mine Bay of the Tsushima Island located in the southern part of the Japan Sea, coastal lake Kamo-ko of the Sado Island in the central part, and coastal lakes Otadomari-numa of the Rishiri Island and Kushu-ko of the Rebun Island in the northern part.

3. Methods

Eight borehole samples were taken from these coastal areas: TN from Nita Bay, TM from Mine Bay, RO-3, 4 from Otadomari-numa, RK-1,2 from Kushu-ko, SK-1,2 from Kamo-ko. The total length of the samples is about 200 m. These samples cover the last 10 ky record. Sedimentary facies, grain size, diatom, mollusk, chemical, and C-14 dating analyses were done.

4. Results

Columnar sections of these boreholes with data of chemical and grain-size analyses are shown in figures. TN of the Tsushima Island, RK-1 and RK-2 of the Rishiri Island, and SK-1 of the Sado Island are only shown.

5. Discussion and conclusion

Most of Japanese rivers show meandering and braided rivers due to steep gradient. In a meandering river system, the rise of sea level induces high accumulation rates on fluvial and deltaic plains due to often floods[3]. Most of sediment supplied by rivers are deposited on these plains during the rise of sea level. However in a braided river system shown by examples in Nita Bay and Mine Bay, the sedimentary facies and distribution of accumulation rates show that intertidal to subtidal zone is a major depositional center during the rise of sea level and this sediment consists of coarser materials with abundant plant fragments[4]. Moreover accumulation rates on fluvial and deltaic plains in meandering river system and intertidal and subtidal areas in braided river system during the rise of sea level are higher than those during the fall of sea level.

The major influences of the rise of sea level in other study areas were coastal erosion and the formation of barrier system. Coastal retreat induced by the future sea-level rise is estimated to be 1.5-1.8 times faster than the present coastal retreat [5]. Sediment yield by coastal erosion is transported alongshore and forms barrier island systems. The existence of barriers, tidal deltas and these complex indicate high sediment yield due to coastal erosion usually. Boreholes taken from the Kushu-ko of the Rebun Island, the Otadomari-numa of the Rishiri Island and the Kamo-ko of the Sado Island show bay-mouth sand-gravel piles formed during the rise of sea level and following highstand of sea level. Presently these barrier systems are not active. 4-5 thousand

years ago, these systems characterized by flood tidal deltas were abandoned related to the fall of sea level in the middle Holocene.

References

1)IPCC WG1(1990): Climate Changes. IPCC Scientific Assessment, Cambridge Univ. Press, 365p.

2)IPCC WG2(1995): Scientific Assessment of Climate Change. Cambridge Univ. Press, In press.

3)Saito, Y.(1995): Sequence stratigraphy of an incised-valley fill at active plate margins: latest Pleistocene-Holocene examples from the Kanto Plain of central Japan. Mem.Geol.Soc.Japan, no.45, 76-100.

4)Saito, Y., Yokota, S., Ikeda, K., Hasaka, T., Inouchi, Y., Akamatsu, M., Matsumoto, E., Yamazaki, N., Oguri, K. and Ohshima, K. (1995): Sequence stratigraphy of an incised-valley fill consisting of the latest Pleistocene-Holocene coarse-grained delta, Nita Bay of the Tsushima Islands, western Japan. Mem.Geol.Soc.Japan, no.45, 61-75.

5)Sunamura, T.(1988): Projection of future coastal cliff recession under sea level rise induced by the greenhouse effect: Nii-jima Island, Japan. Trans. Japan. Geomorphol. Union, 9, 17-33.

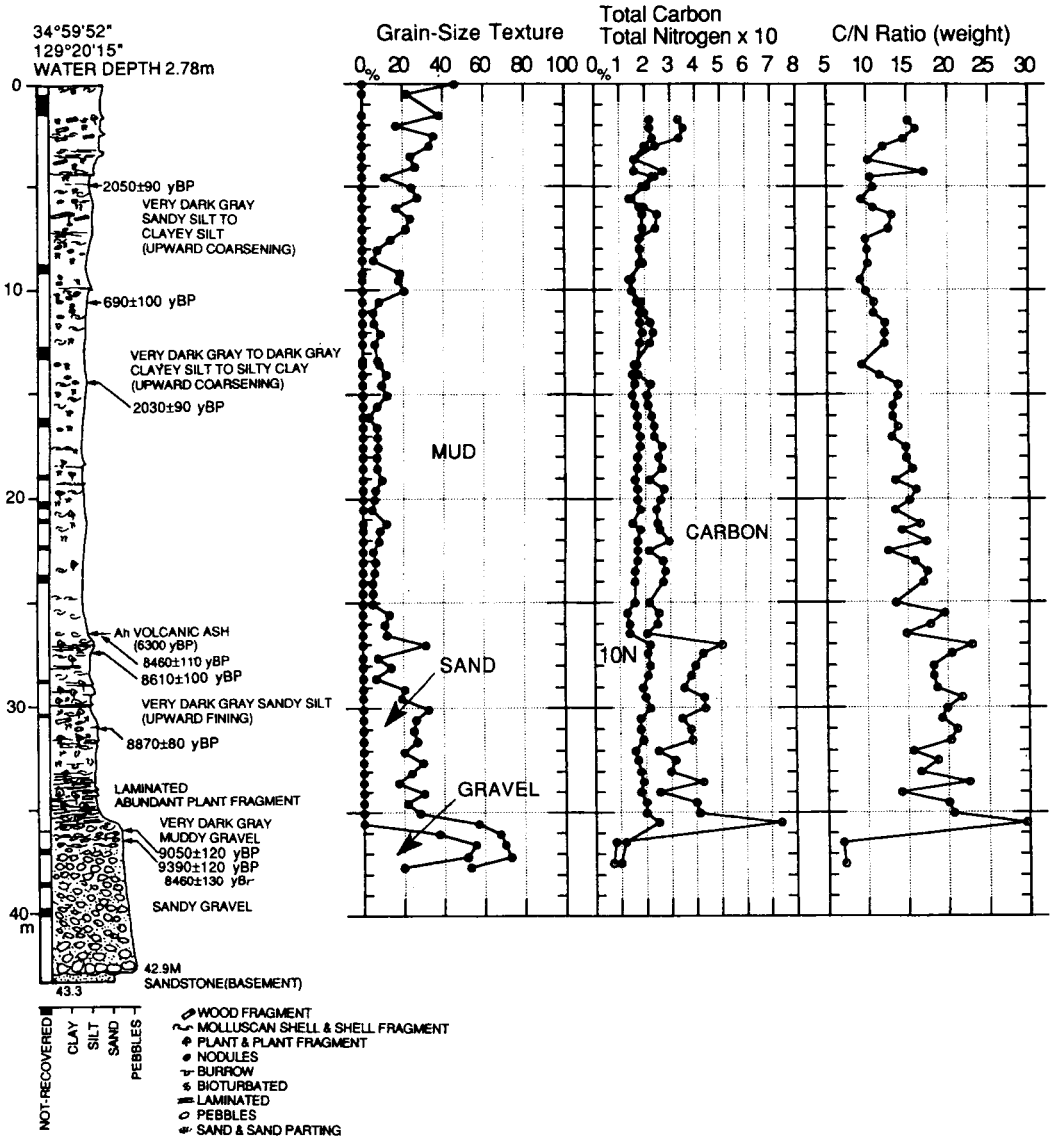

Figure 1 Columnar section of borehole TN from Nita Bay of the Tsushima Island.

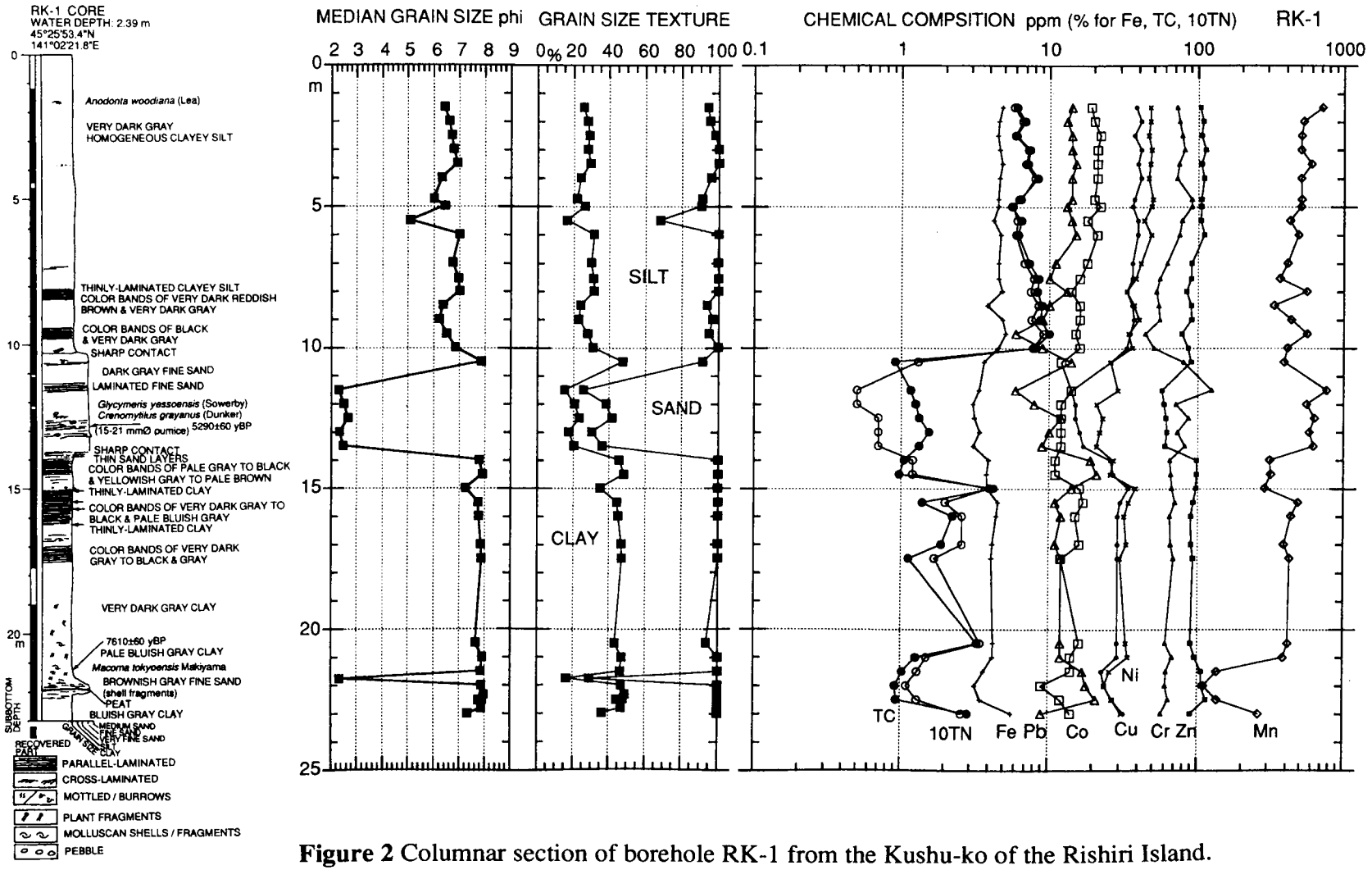

Figure 2 Columnar section of borehole RK-1 from the Kushu-ko of the Rishiri Island.

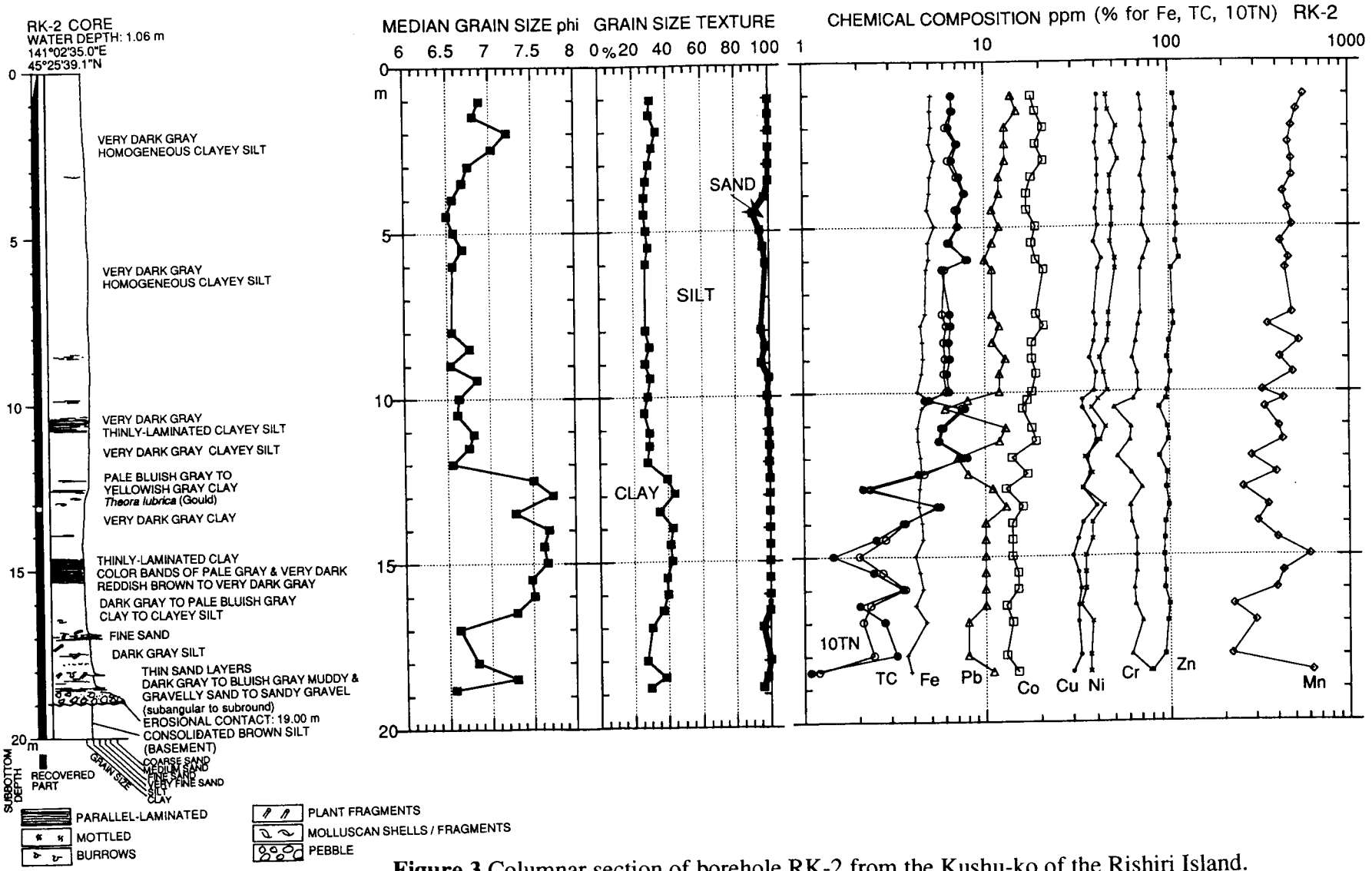

Figure 3 Columnar section of borehole RK-2 from the Kushu-ko of the Rishiri Island.

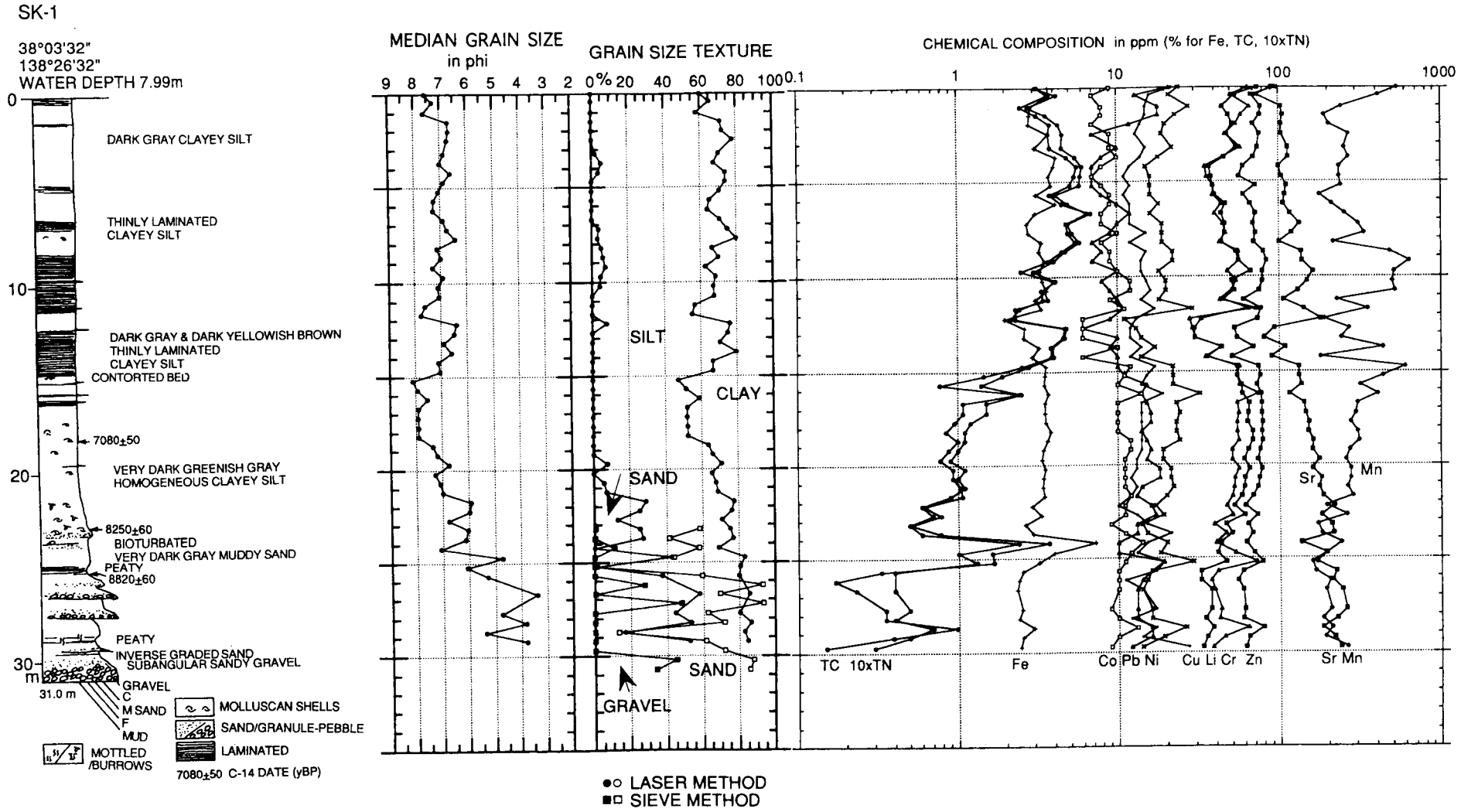

Figure 4 Columnar section of borehole SK-1 from the Kamo-ko of the Sado Island.