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GEO-ENVIRONMENTAL ANALYSIS IN THE RECENT ALLUVIAL PLAINS OF THE LARGE MENDERES AND THE SMALL MENDERES

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In the recent alluvial plains of the Large Menderes and the Small Menderes, there were some harbor-cities called Priene, Milet, and Ephesos. Although these harbor-cities prospered during the ancient Greek period and the ancient Roman period, they have become ruins. These harbor-cities are now located far from the present coast, as the coastline has since moved dramatically. How did the coastline move at the historical period, why did it move, and how did the city residents cope with the change?

In order to examin the relationship between natural environment and human activites, this paper deals with the following points.

1) Geo-environmental analysis was adopted as the investigation method (Fig. 1).

2) Denuded mountains exisit largely in the large Menderes basin and small Menderes basin. Dryness is the cause of the balded Mountains (type 1). Denuded Mountains (type 2) aren't related to the air-humidity. Pasturage of sheep and goats have been continued in denuded Mountains (type 2). The authors think that pasturage made the denuded mountains (type 2).

3) The authors carried out boring investigation on the large Menderes basin and the small Mederes basin. Stratums are important date for examining changes in the natural environment. Stratums record the history of development.

4) The sea area spread to the fans zone where tributaries formed. Kraft et. al. (1977) thought that it was 3500 years before present, but the authors think that it was about 6300 years before present.

5) Ephesos (fig. 13), Priene (fig. 14) and Milet (fig. 15) were thought to be harbor-cities that directly faced the sea. But the results of geo-environment analysis suggest that all harbor-cities faced abandoned channels. In the case of examining the geo-environment of harbor-cities, the authors must consider coast and river.

Key words: THE LARGE MENDERES, THE SMALL MENDERES, GEO-ENVIRONMENT ANALYSIS, FLOOD, DENUDED MOUNTAINS.

METHODOLOGY

Geo-environment analysis was adopted as the perferred method of investigation (Fig. 1 reference). The authors could not use air photographs because of the military regulations. Instead, the SPOT (artificial satellite) data was used. Machine drilling was used in the recent alluvial plains of the Large Menderes and of the Small Menderes in order to investigate the deposit of the recent alluvial plains and to collect deposits for a micro fossil analysis and a geo-chemical analysis. Furthermore, a survey was carried out along the rivers to document forms of land use, microgeomorphology, vegetation, and climate.

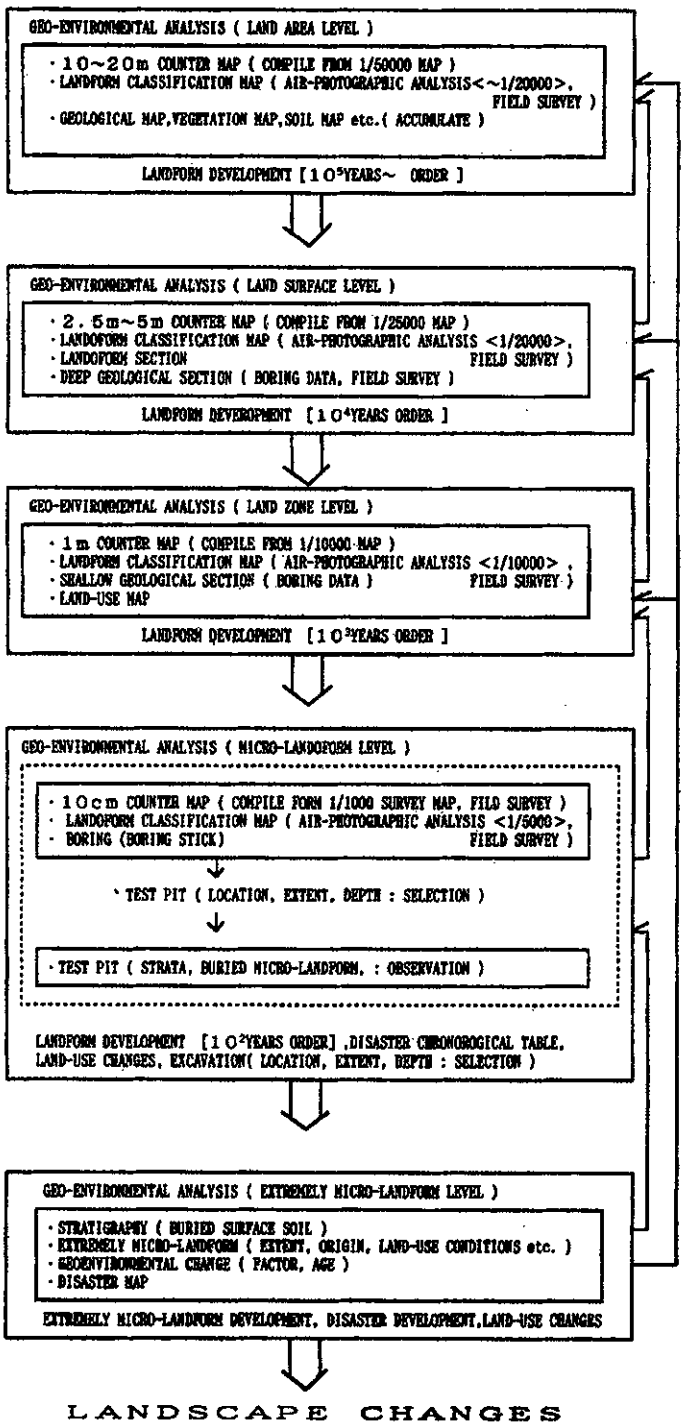

Fig. 1. System of the geo-environment analysis.

REGIONAL OUTLINE

The Large Menderes flows from the Anatolian Plateau in the southwestern Turkey to the Aegean Sea (Fig. 2). It was called with Maiandros in ancient times, but is now called "Büyük Menderes Nehiri" in Turkish. The Small Menderes flows to the north of the Large Menderes and is called "Küçük Menderes Nehiri" in Turkish. The name Menderes derives from a topographic term "Meander", which indicates the meandering name of both rivers. This area is affiliated with the Mediterranean climate. Both the Large Menderes and the Small Menderes are running inside

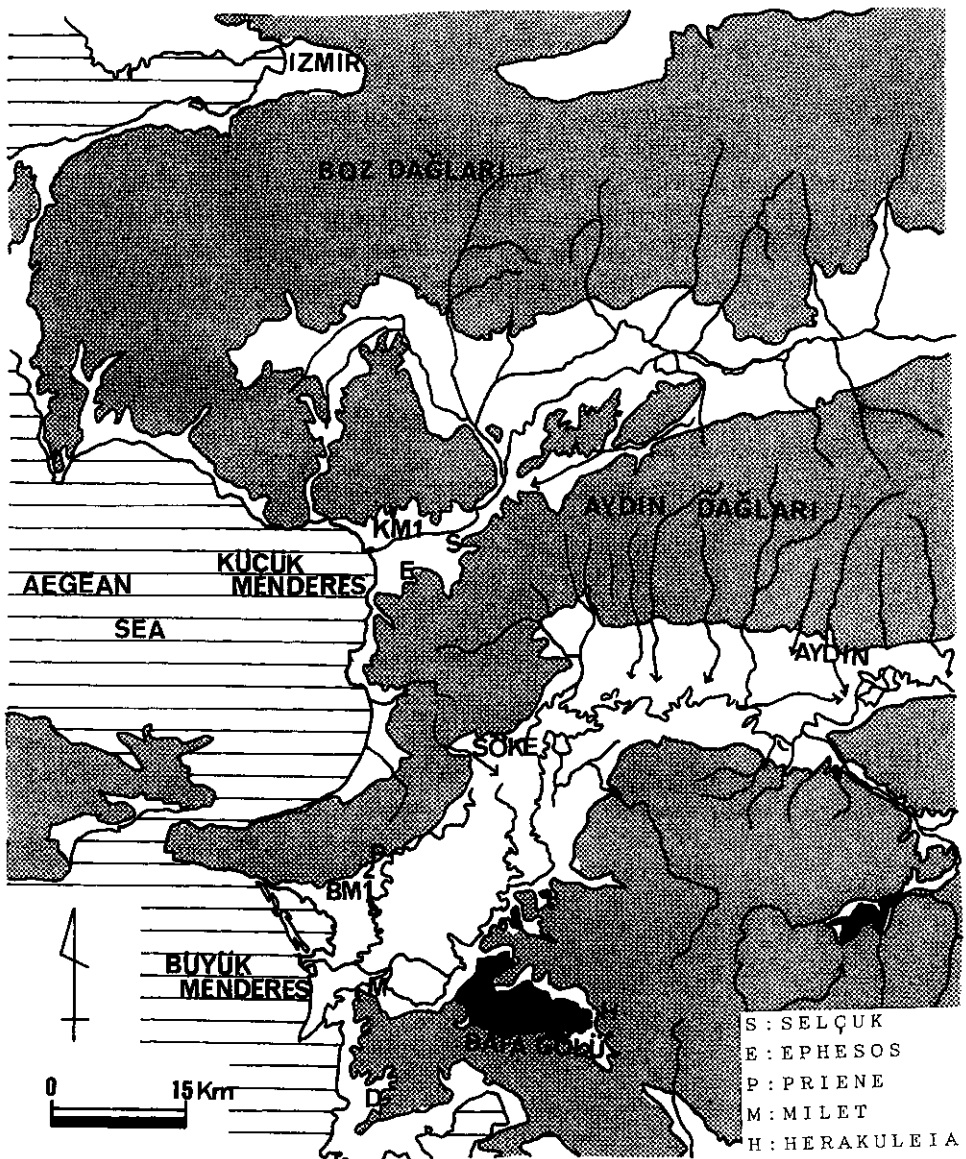

Fig. 2. Location of the study area.

a tectonic valley.

Aydin Dağlari (mountains in the north of the Small Menderes) and Boz Dağlari, which are located between the two rivers, are mostly composed of schist, with some marble intrusions. On the other hand, the geology to the south of the Large Menderes is rather different, as gneiss forms the majority of rock in this area.

Huge quantities of large pieces of marble were used to construct buildings of the ancient harbor-cities in the Greek and Roman periods. The site of these cities corresponds to distribution of marble within the landscape.

DENUDED MOUNTAINS IN THE LARGE MENDERES BASIN

Denuded mountains exist largely in the Large Menderes basin (Fig. 3). It is possible to separate the cause of denudation into two categories. Type 1 is a result of dry condition. This type of denuded mountains exist in inland. According to a simple observation, the air-humidity was measured between 75 and 55% in the coastal area. The air-humidity drops more drasfically around Aydin as one travels inland (distance from the coast: 70 km), and falls below 20% at Nazilli, 100 km from the coas. The sea has an influence on the air-humidity within 100 km from the coast.

Another type of denuded mountains (type 2) is distributed around settlements (Fig. 4) and their formation is not related to the air-humidity, although they also exist near the coast. Sheep and goats have been pastured in the denuded mountains of the second type. It is likely that overgrazing of animals caused the denudation.

Fig. 3. Denuded mountains in the Large Menderes basin (spot image).

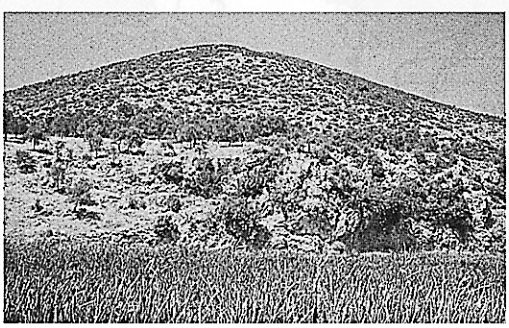

Fig. 4. Denuded Mountains (type 2).

Many olive trees are found in the mountains around the settlements while pine trees grow in the heart of mountains.

GEO-ENVIRONMENT IN THE LARGE MENDERES BASIN

The Large Menderes basin is a tectonic valley. To be more exact, however, the formation of each of its banks is very different. The faults form the boundary between the low land to the left and the mountains to the right. Short, but fast tributaries flow from Aydin Dağlari. The tributaries have formed fans at the foot of the mountains. On the contrary, tectonic valleies are dominant on the left bank running.

The SPOT imege shows that, the town of Söke, in the upper reaches and above, the tributaries formed many fans. On the other hand, downstream from Söke, the Large Menderes forms deltas. These areas are called respectivel as the fans zone, and deltas zone. Many principal cities, such as Aydin, Nazilli and others are located in the fans zone. These cities were originally formed villages around the springs at the end part of the alluvial fans.

The Large Menderes skirts Aydin. The influences of Large Menderes, however, is limited to a narrow range. The Large Menderes causes erosion of the fans zone. As a result, the fans zone is transformed into terraces.

In the deltas zone, influences of the Large Menderes are significant. Old, dry channels of the Larege Menderes remain here and there in the deltas zone (Fig. 5), which are today used for

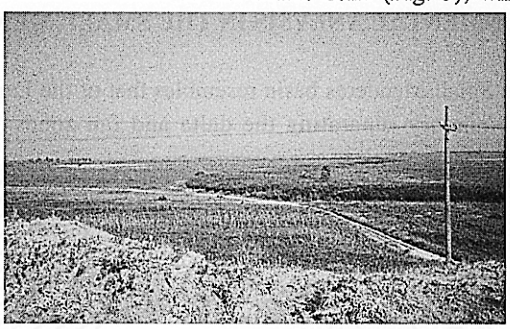

Fig. 5. Abandoned channels of the Large Menderes.

melon cultivation. *Typha angushfolia* grows thick by in some abandoned channels that are not converted into melon fields. There are many artificial waterways in the deltas zone, which were often dug for irrigation. Cotton is currently grown there. The coastal area is wasteland, where farmlands have become unusable in the backswamp and on the periphery of the lake lagoon.

There is a lake lagoon called Dil Golü on the right bank of the Large Menderes, separated by sand banks at the mouth of lake lagoon that opens toward the bay. An old sand bank on the east side of the lake lagoon carries a road way. There is a lake called Bafa Golü to the east of Milet which was once a bay. There is a possibility that the encroaching sand bank have closed off the mouth of the bay and a lake lagoon was formed. Another possibility is that Bafa Golü was left behind from the formation of the fluvial deposit.

BM-1, BM-2 DRILLING INVESTIGATION

The authors carried out a drilling programme in order to investigate the subsurface geology of the Large Menderes basin. The aim was to examine changes of the natural environment. Stratigraphy became clear through the examination of samples, and they also provided important data for examining changes of the natural environment.

Places with stable sedimentary environment were selected for drilling sites (BM-1, BM-2). By the geo-environment analysis, landforms of the drilling spots were classified an deltas zone (backswamp). Today, the research areas are wasteland, although once cultivated. Drilling sites were located between ridges of the mountains that are composed of marble. It was the place that does not receive much influence of the Large Menderes. Olive trees are grown on the mountains. Settlements are located in the fans zone that were formed by the tributaries. The geology of the area is reflected on plants. *Convolrulus aruensis, Inula viscosa, Arundo donax* indicate that the fans zones project beneath the deposits of the deltas zone. *Typha angushfolia* is the dominant in the backswamp.

The state of strata revealed by the drilling is shown in Figs 6 and 7. The stratigraphy resembles very much to that of the recent alluvial plains (type L) in Japan. Existence of a flood deposits, however, (underground -11.0m～-11.5m) differs from the recent alluvial plains in Japan. Fig. 8 showes the section of the strata that is suggested by the drilling data and the micro-landforms.

GEO-ENVIRONMENTAL ANLYSIS IN THE SMALL MENDERES BASIN

Basic structure of the Small Menderes basin resembles that of the Large Menderes. The gorge around Selçuk is the boundary separating the delta and fan zones. Some sand banks have

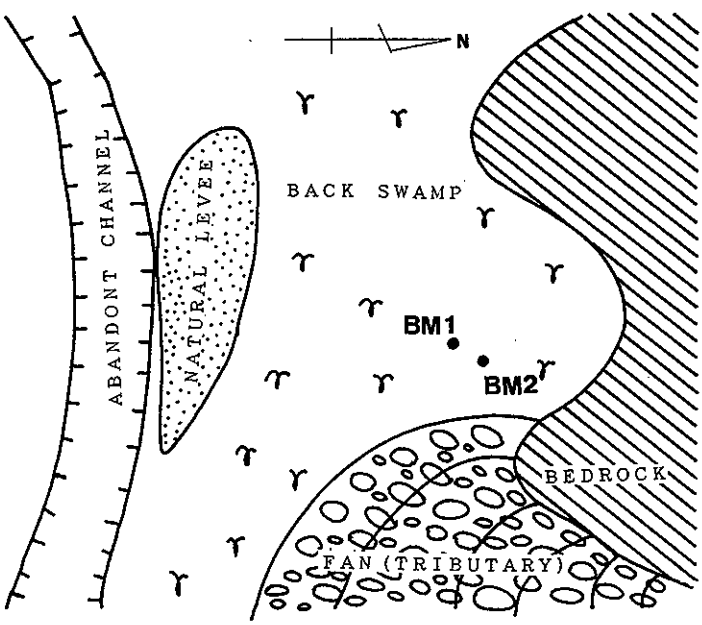

Fig. 6. Boring point.

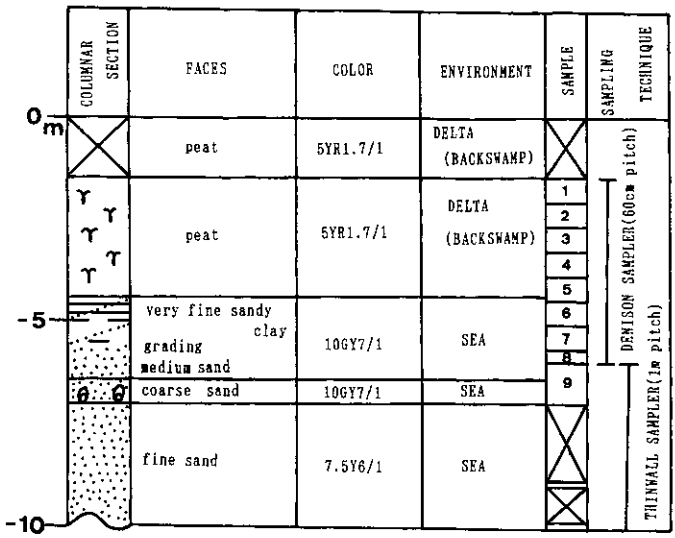

Fig. 7-1. BM-1 Boring.

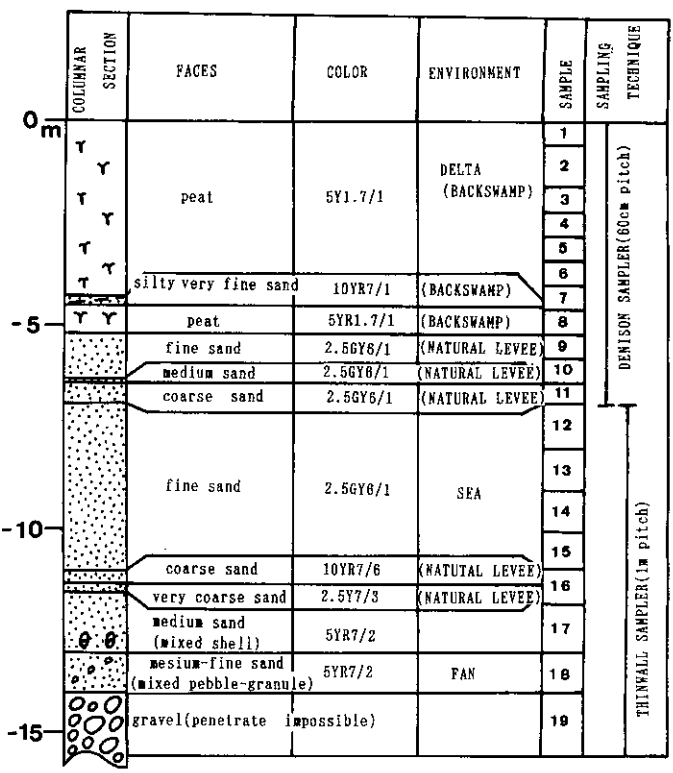

Fig. 7-2. BM-2 Boring.

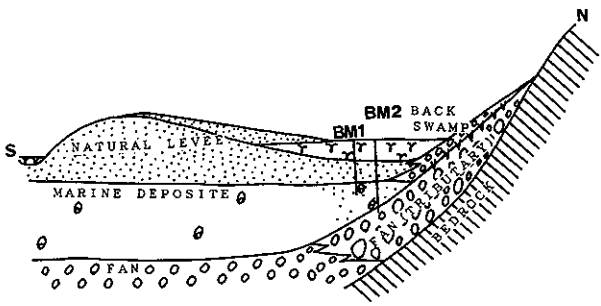

Fig. 8. Geological section.

developed in the deltas zone. A lake lagoon once existed on the inland side of the sand-bank. By the time of our investigation, the lake lagoon had disappeared. Tamarisk grows densely, and an edible plant (sueda) grows occasionally where the lake lagoon existed. The land around the lake lagoon had been used as a field.

KM-1 DRILLING INVESTIGATION

A drilling site was selected for KM-1 using the same criteria as for BM-1 and BM-2. The drilling site KM-1 (N37°58′ 52.7″ E27°16′ 11.4″) is a swampy island that is surrounded by the mountains. The drilling site receives little impact from the Small Menderes. This drilling result is similar to that of the Japanese deltas zone (D type). Gravel existed at-19.5 m from the recent surface (Fig. 9). The sample probably indudes the valley material of the last glacial period. The result of the geo-environmental analysis indicates that, in the basin of Large Menderes, the sea area spread as far to the fans zone formed by the tributaries. Similarly, in the Small Menderes basin, the sea extended downstream to the gorge of Selçuk. Kraft et.al. (1977) thought this was 3500 years before present, but it is more likely to have been at about 6300 years before present.

Ephesos (fig. 10), Priene and Milet were harbor-cities once thought to have directly faced to the sea. The result of the geo-environmental analysis, however, suggests that all harbor-cities faced to the now abandoned channels. Therefore, it is necessary to consider the coast and the rivers when examining on the geo-environmental conditions of the harbor-cities.

POSTSCRIPT

It has been difficult to obtain sufficient information for a comprehensive analysis and many questions still remain to be answered. However, the authors believe that geo-environmental analysis was a valuabletechnique and would welcome another opportunity to carry out their research.

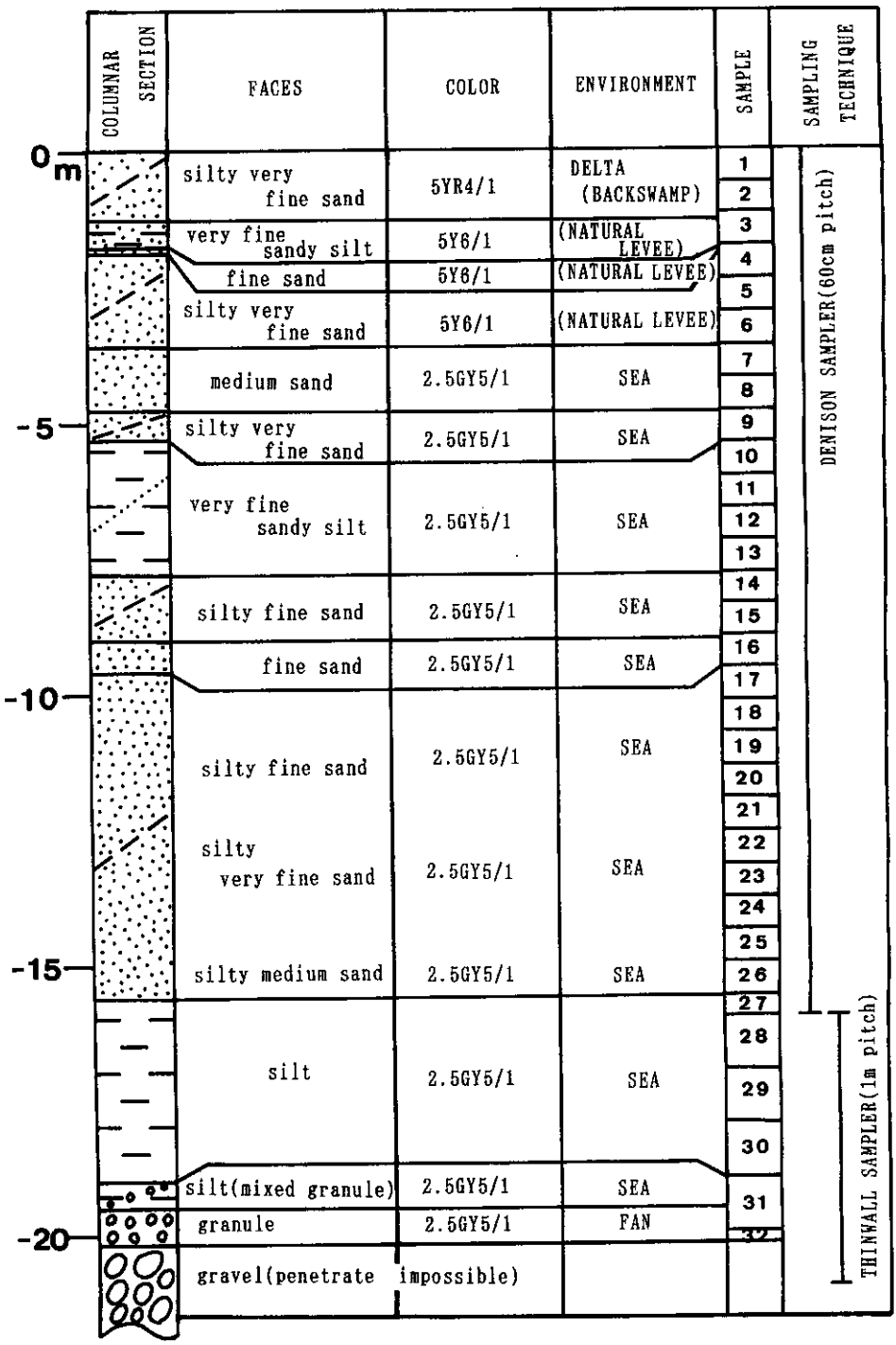

Fig. 9. KM-1 Drilling.

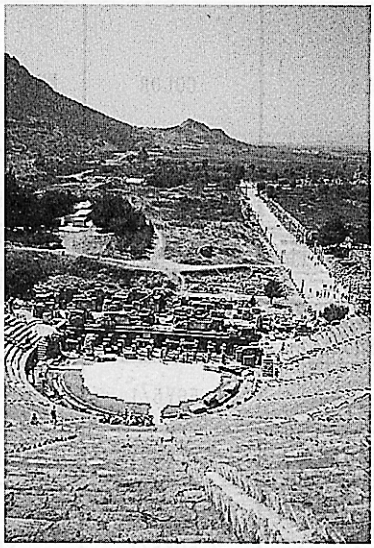

Fig. 10. Ephesos site.

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大メンデレス川、小メンデレス川流域平野の地形環境分析

高橋　学

要旨：大メンデレス川、小メンデレス川の流域平野には、プリエネ、ミレトス、エフェソスと呼ばれる港町があった。これらの港町は古代ギリシャ時代や古代ローマ時代に繁栄した。しかし、今、これらの港町は遺跡になっている。これらの港町は、現在、海岸から遠く離れてしまったところに位置しているのである。

この論文では筆者は、自然環境と人間活動との関係について調査した。

1）地形環境分析が調査方法として用いられた（図1）。

2）大メンデレス川、小メンデレス川流域には、広い面積にわたって禿山が存在している。禿山のうちタイプ1に属するものは、乾燥した気候が原因である。これに対し、タイプ2の禿山は乾燥した気候が原因というよりは、人間の活動と密接な関わりがあると考えられる。山羊や羊の放牧がタイプ2の禿山と関わりがある。

3）大メンデレス川、小メンデレス川においてボーリングをおこなった。自然環境の変化を調査するために地層は重要な資料である。

4）かつて海は、支流の形成した扇状地帯まで広がっていた。クラフトらはこれを

3500年前のことと考えていた。これに対し、筆者はこれを6300年前のことと考えている。

5）エフェソス、プリエネ、ミレトスは、海に面した港町と考えられている。しかし、地形環境分析の結果、これらの港町は旧河道に面していることが明らかになった。港町の地形環境を調査するとき、海岸だけでなく河川についても考慮する必要がある。