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THE INFLUENCE OF HOLOCENE ENVIRONMENTAL CHANGE ON HUMAN ACTIVITIES IN THE DAEGU BASIN, KOREA, DURING PREHISTORIC AND ANCIENT TIMES

ABSTRACT: YOON S.O. & HWANG S.I., *The influence of Holocene environmental change on human activities in the Daegu basin, Korea, during prehistoric and ancient times.* (IT ISSN 1724-4757, 2003).

The strong influence of nature on human life during ancient times requires that people must have chosen their habitats based on the limits of their technology, especially of farming technology, and an understanding of natural conditions. To verify this assumption, the correlation between natural environment and habitat placement in the Daegu basin in Korea over the recent Holocene has been investigated. In this paper, we attempt to correlate various changes in the natural environment of the Daegu basin with the location of burial sites, cultivated fields, and residential areas during the Bronze Age, the Iron Age, and the proto-Three Kingdoms Age. We also compared the changes in location and extent of inhabited areas to the development of tools, soil characteristics, and to the climatic changes based on the sea level changes during the Holocene. We conclude that people probably did limit their habitats according to their understanding of their environment and their technology.

KEY WORD: Natural environment, Sea level change, Archeological Age, Tool, Daegu basin, Korea.

INTRODUCTION

The archaeological research on prehistoric and ancient times has been mostly based on excavated relics and remains, since documents from these times are rare at best. From the point of view of physical geography, to understand ancient human life it isn't enough to rely solely on archeological research. The better approach is to examine the archeological data on the interrelation between human life and nature, because people should have selected their living places based on their long-term experience with the natural environment.

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The archaeological stages in Korea classified by Kim (1995) are The Neolithic Age (7,000 BP to 3,000 BP), the Bronze Age (3,000 BP to 2,300 BP), the pre-Iron Age (2,300 BP to the beginning of the Christian era) and the proto-Three Kingdoms Age (or Kimhae Age) from the beginning of the Christian era to 1,650 BP. These last two are together equivalent to the Iron Age (2,300 BP to 1,650 BP).

The Daegu basin was chosen for the study because the density of remains since the Bronze Age is very high compared with the deficiency of older remains during the Paleolithic and the Neolithic Ages, and also because before this paper there has been no study treating the spatial characteristics of the Daegu basin remains geomorphologically. Furthermore, the distribution of remains over time in the Daegu basin has not been well correlated with changes in the environment, and this study provided a good opportunity to do so. We attempted to relate the remains in the Daegu basin to the Bronze Age, the pre-Iron Age, and the proto-Three Kingdoms Age (fig. 6, 7, 8). We investigated the spatial changes of human activities in relation to the developments of tools, the characteristics of soils, and flood possibilities over the floodplain according to the climatic changes with the sea level change during the Holocene.

THE DAEGU BASIN

Kumho river is the largest river in the Daegu basin, flowing generally westward across it. It is joined by the river Sincheon flowing north from Mt Ap (659.0 m) and Mt Bisle (1,083.6 m). The Kumho then flows into the river Naktong (525.2 km), the longest river in Korea (fig. 1, 2). Mt Palgong (1,192.8 m), which is northern divide of Daegu basin, is located north of the Kumho river. It is composed of granitic rock, and surrounded by a ring-type mountain range of metamorphic sedimentary rock. Mt Ap and Mt

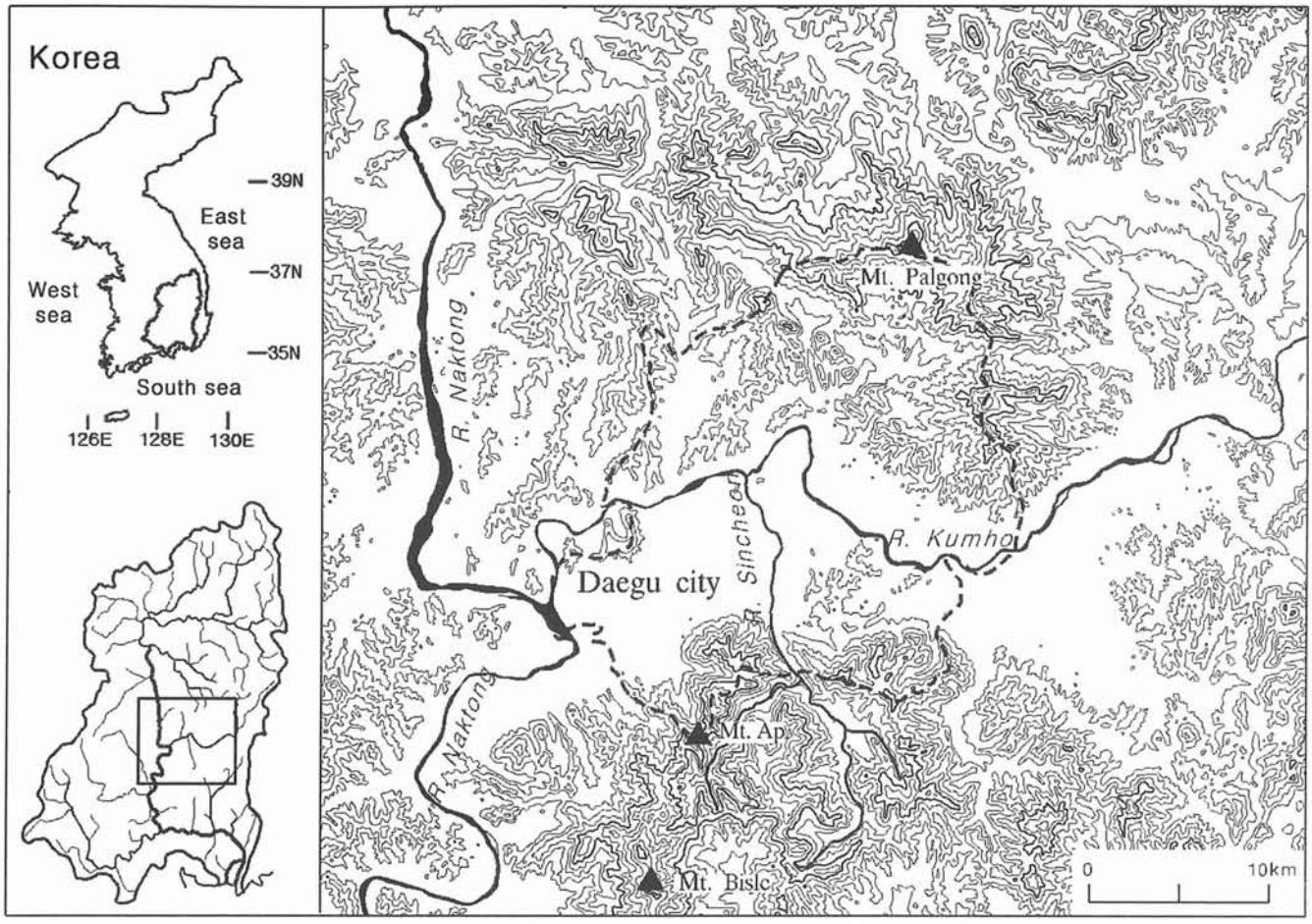


FIG. 1 - Topographic map of the Daegu Basin.

Bisle at the southern divide of the Daegu basin are very high mountains composed of andesitic rock. The other areas in the Daegu basin are composed of sedimentary rocks. The northern edge of Kumho river is directly bordered with hills of sandy and conglomerate sedimentary rocks which are higher than the area around the southern side of the river. The southern area is the center of the Daegu basin and it is composed of the broad floodplain of Sincheon river and an eroded etchplain with hills of shale rock.

The spatial range of this study is limited to the area south of Kumho river, where the density of relics is high, and many archaeological findings have been accumulated.

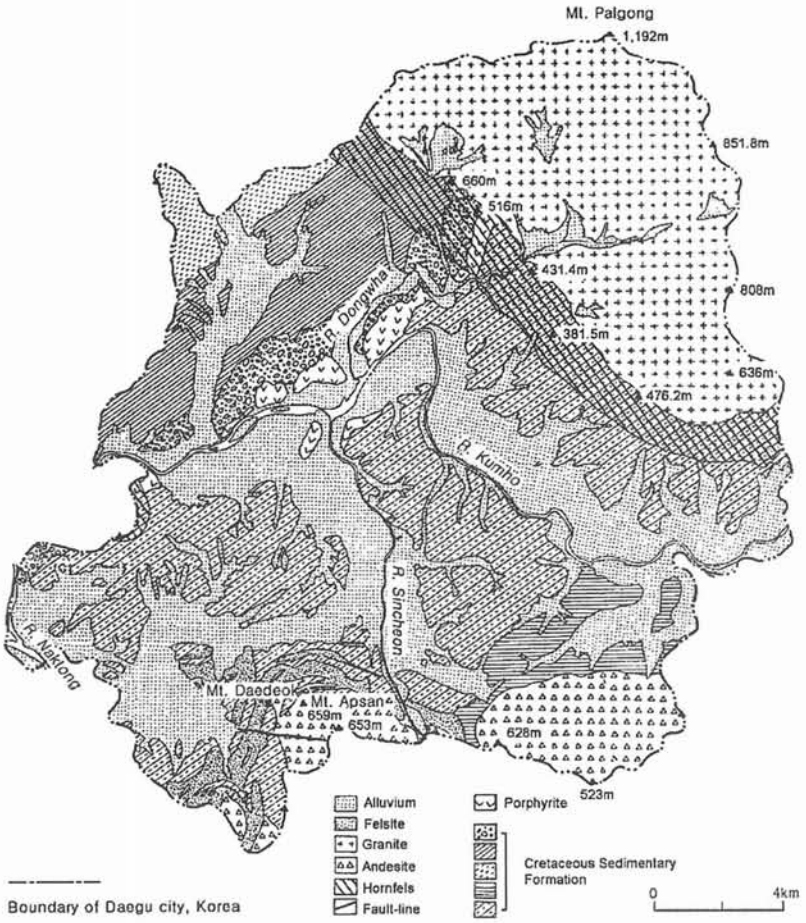
SEA LEVEL AND SHORELINE DURING THE HOLOCENE TRANGRESSION

The effects of environmental changes on human activities can be traced through the reconstruction of sea level fluctuation, global climatic change and geomorphological differences on the floodplain in Korea during the Holocene. It is likely that the Daegu basin was affected by the tides at Gimhae bay (the mouth of the Naktong), in spite of its long distance from Gimhae, owing to the gentle slope of the river channel. Because the basin's valleys were only thinly covered by sediment several thousand years ago, the fluctuations in water level of Naktong river were able to reach far inland and influence the downstream regions of the Kumho, its tributary, on the inland side of the Daegu basin.

Sea level fluctuation

This is the curve of sea level change in the Ilsan area near the lower reaches of Han river flowing to the West Coast of Korea. It was determined by Hwang & *alii* (1997) from diatom analysis and C^{14}-dating. The sea level change since 7,000 BP is interpreted as follows: the rate of sea level rise since the climax of the last Glacial period was very rapid by 7,000 BP. It rose to 1 meter lower than present by 7,000 BP, after that rising slowly to 0.8 m higher than present between 6,000-5,000 BP, and falling slowly and stabilizing around 3,200 BP. Between 3,200 BP and 2,300 BP it dropped 0.8 m. After that it rose again to a mean

FIG. 2 - Geological Map of the Daegu Basin, Korea (The History of Daegu City, 1995).



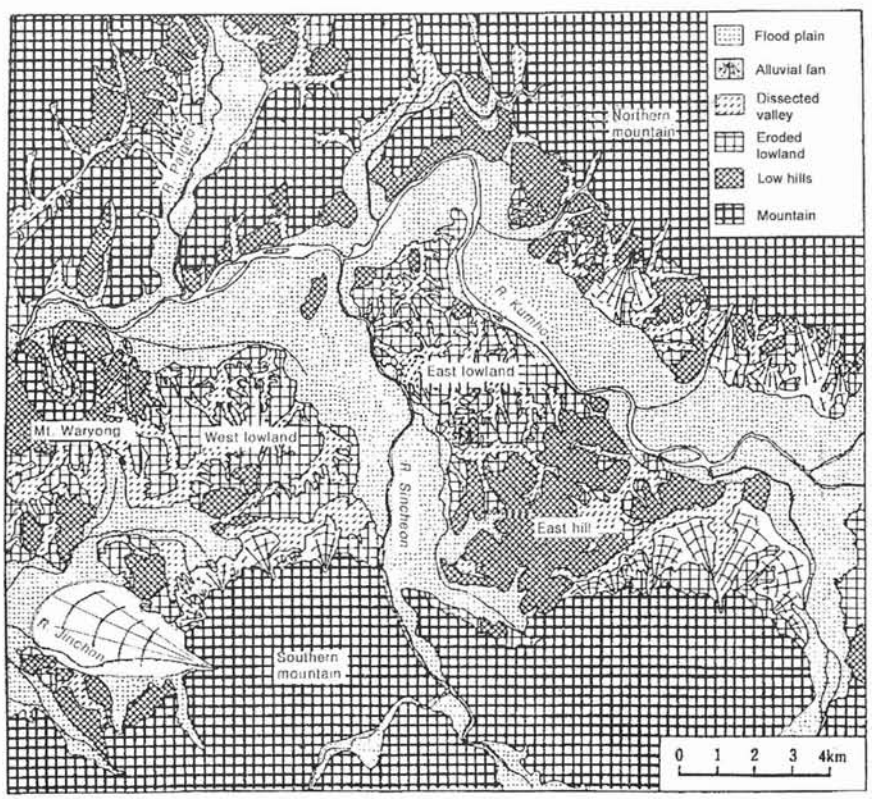


FIG. 3 - Classified Geomorphological Map of the Daegu Basin, Korea (The History of Daegu City, 1995).

high tide sea level of 5.8 m. It was 1.1 m higher than at present, and the highest sea level was reached during 2,000-1,800 BP. We correlate the sea level change since 7,000 BP to the archeological Age in tab. 1.

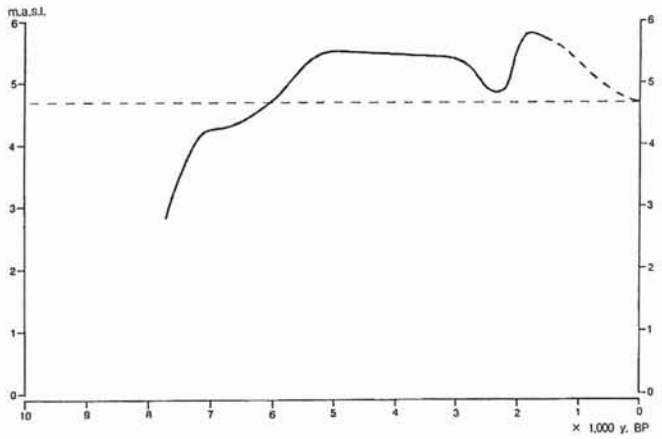


FIG. 4 - The sea level curve of Ilsan, the West Coast, Korea (Hwang & *alii*, 1997, --- presents mean high tide sea level).

TABLE 1 - Archeologic age and coastal environmment at Ilsan during the Holocene

Period	6,000-5,000 BP	5,000-3,200 BP	3,200-2,300 BP	2,300-1,800 BP
Sea-level change	rising	rising and stable	falling	rising and stable after rising
Coastal change	transgression	gradual regression	regression	transgression
Archeologic stage	Neolithic Age	Neolithic Age	Bronze Age with late Neolithic Age	pre-Iron Age, proto-Three Kingdoms Age

Reworked from Hwang (1998)

The shoreline during the maximum of Flandrian transgression

The mouth of Kumho river is located about 190 km upstream from the South Coast estuary of Naktong river. The Daegu basin is supposed to have been indirectly affected by sea level fluctuation during the Flandrian transgression. We have sought the shoreline of those days in order to understand the effect of sea level fluctuation in the Daegu basin after Jo (1987). The Naktong river valley bedrock is buried under the alluvial plain on the downstream range of the Naktong river and its greatest depth is determined from river erosion by the base level fall during the Last Glacial Maximum.

Its deepest point is estimated to be ca. -70 m.a.s.l. on the coast. This erosion valley was drowned and the stream inland was affected by the transgression at the peak of the sea level rise.

The location of the height of the riverbed during the Last Glacial Maximum, corresponding to the present-day sea level (0 m a.s.l.), is related to the drowned range of the valley up to the direct limit of transgression on the floodplain. Fig. 5 presents the river profile of the lower stream Naktong river during the Last Glacial Period and the location of shoreline reached during the climax of Flandrian Transgression.

The location of the shoreline in the erosion valley at the peak of the transgression can be found 160 km upstream from the mouth of Naktong river. And the height of sea level was supposed to be 0.8m higher than present, judging from the result at Ilsan area on the floodplain of Han river during 6,000-5,000 BP. This means that sea level fluctuation could have had influenced on the Daegu basin directly, taking into account the 1.2 m of the tidal range at the mouth of Naktong R.

The shoreline during the Bronze Age from 3,000 to 2,300 BP is thought to have been recessed toward the Naktong's lower stream farther than it was during 6,000-5,000 BP because of the lower sea level and the sediments produced from the upper stream. The fact that ship traffic was possible along the river Naktong from Gimhae city (river mouth) to Andong city (200 km upstream) up to the early days of the 20C, demonstrates that the Daegu basin was influenced indirectly by the sea level fluctuation ca. 3,000 BP in spite of the lack of definite data.

RELICS AND NATURAL ENVIRONMENT IN THE DAEGU BASIN DURING THE PREHISTORIC AND ANCIENT TIMES

Relics from the Paleolithic Age have not been found to date, and from the Neolithic Age only some striated wares excavated on the floodplain of Donghwa river, a northern tributary of Kumho river during that time. It is supposed that human beings didn't continuously inhabit the region.

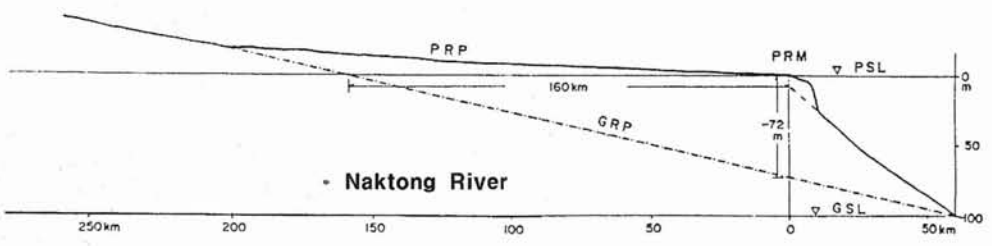
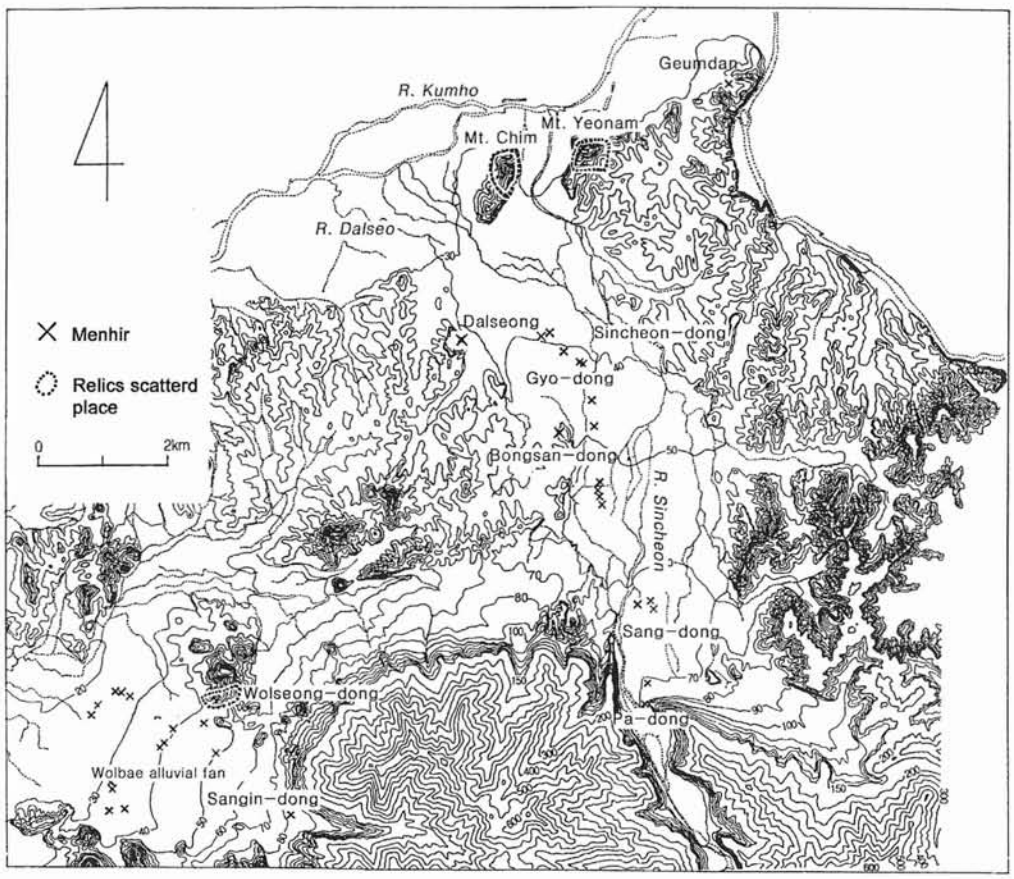


FIG. 5 - Present-day river profile and estimated profile from Naktong river during the Last Glacial Maximum (Jo, 1987). (PRM: Present Rivermouth, PSL: Present-day Sea Level, GSL: Sea Level during the Glacial Period, PRP: Present-day River Profile, GRP: River Profile during the Glacial Period).

FIG. 6 - Location of human activities during the Bronze Age.



THE BRONZE AGE

Distribution of sites

Menhirs, the typical tombs of the Bronze Age, are concentrated mostly on the natural levee of the Sincheon river and the Wolbae alluvial fan. But only the menhirs at Bongsan-dong(village) and the excavation places of the unstriated earthen wares in the Dalseong castle and the Geumdan mudwall were located on the hillside on sedimentary rock.

Some menhirs on the floodplain of Sincheon river are located at Pa-dong and Sang-dong on the right hand of the levee, around the upper- and middle stream of Sincheon river flowing down from Mt Ap. They are also located on the left hand of the natural levee parallel to the river from Daebong-dong to Dongin-dong. The menhirs from Gyo-dong follow a rough line WNW, in a different direction to their line along the upperstream. The distribution of menhirs indicates the paleochannel of Sincheon river. One tributary of Sincheon river flowed to the west, differently from the present northward flow. We can estimate the paleochannel from the lie of the houses, an orchard, a mulberry field, and a dry field on the area map of 1917.

Menhirs are also distributed all around the Wolbae alluvial fan, and are especially concentrated on the lower boundary of the fan, where water could be obtained easily. The boundary of the menhirs also corresponds to residential areas during the early days of the 20C. This means that the fan surface during the Bronze Age was very stable, safe from floods, and was probably used for cultivated fields, graveyards, and residential areas.

In addition to menhirs, the ruins and several places of scattered remains are also important indicators of the Bronze Age. In the Daegu basin, the ruins are at Wolseong-dong on the northern hillside at 138 m a.s.l. (to the north of the Wolbae alluvial fan), on the southern side of Mt Yeonam, at Dalseong Castle, and on the western and northwestern slopes of Mt Chim. These places are all located on the gentler mountain slopes.

The influence of natural environment on human activities

The soils on the natural levee of Sincheon river, composed of sands and gravels, are drained very well, but soil depth is thin. The soil surface is 20 cm thick with brown color, and is characterised as loamish sands, or sands with dark brown- or yellowish brown gravels. The soil of the natural levee, so called Hwangryong-tong, was soft and good for farming with the stone tools available in the Daegu basin during the Bronze Age, because it was composed of sands

over 80% per volume. Soils containing 35-50% gravels over the soil horizon are not very fertile owing to little humus.

The soils on the apex and center of the Wolbae alluvial fan containing sands and gravels abundantly are drained very well but are not very productive. The boundary soils of the fan, composed of fine sandy loam, are also fertile, but are worse than the apex or center for drainage. Farming activities on the Wolbae alluvial fan would have been practical using stone tools, and the residents could have removed large stones by hand or with simple tools and cultivated the soil. The sea level was falling during the Bronze Age as shown in tab. 1. This suggests that the degree of flooding was not so great.

Bronze tools from the Bronze Age are rarely found in the Daegu basin. They are thought to have been special things, status-symbolic goods for powerful minorities. There is no evidence that the residents used them extensively as farming implements or weapons. The practical implements were still stone, wood or bone tools. The Bronze Age lifestyle wasn't restricted to agriculture; fishing and hunting were important during this period. The activity space was located along the river, and the excavated relics have been mainly balance weights for fishing and some arrowheads.

The difference in altitude from the northern floodplain of Kumho river (33-34 m) to the southern levee of the tributary Sincheon river from Dongindong to Taepyungno (40-42 m) is about 8 m. The floodplain of Kumho river and the northern floodplain of lowerstream Sincheon river was often so dangerous that people couldn't live there, owing to the danger of floods before the construction of artificial levees. The natural levee and the neighboring area were higher and safer than the floodplain and good for living place or cultivating fields. The central region of Daegu (41-43 m) was so safe that it was used actively as living space (fig. 6).

THE PRE-IRON AGE

Distribution of sites

Magnificent bronze tools have been found, mostly from the pre-Iron Age in the Daegu basin, not the Bronze Age, though tools and sites from the Bronze Age, and also bronze tools made during the pre-Iron Age, are concentrated relatively more densely than in other regions of Korea. These bronze tools are most commonly found in great tombs on the eroded slopes of the low hills of Manchon-dong, Sincheon-dong, Jisan-dong, Pyungri-dong, the north side of Mt Waryong (Bisan-dong), and the valley of Seobyun-dong. They are also found in the hills around Dalseong castle, which has probably been the most important place of the Daegu basin since the pre-Iron Age. It is uncertain how one bronze tool was buried on the floodplain of Sincheon river, not on the Wolbae alluvial fan.

The pre-Iron Age sites containing bronze tools as grave goods are small and few in number. Bronze tools and relics in each site are also very few in number. This is in contrast to the dense distribution of menhirs from the Bronze Age and to the number and size of great tombs from the subsequent the proto-Three Kingdoms Age. Except for the relics at Bisan-dong and Pyungri-dong, the number and the size of the objects and sites from the pre-Iron Age are less than those from the Bronze Age. This seems questionable because the population would be expected to increase more or less continuously, and skills for acquiring food would have improved from the Bronze Age onward. Iron horse equipment and bronze weapons were buried with the remains during this Age. Only a few bronze weapons have been found from the pre-Iron Age in the Daegu basin, no farming tools or no practical objects but those for sacrificial use. In the north of the Daegu basin, north-, and mid-Korea, iron hoes, scythes, crescent shaped sickles and so on have been found.

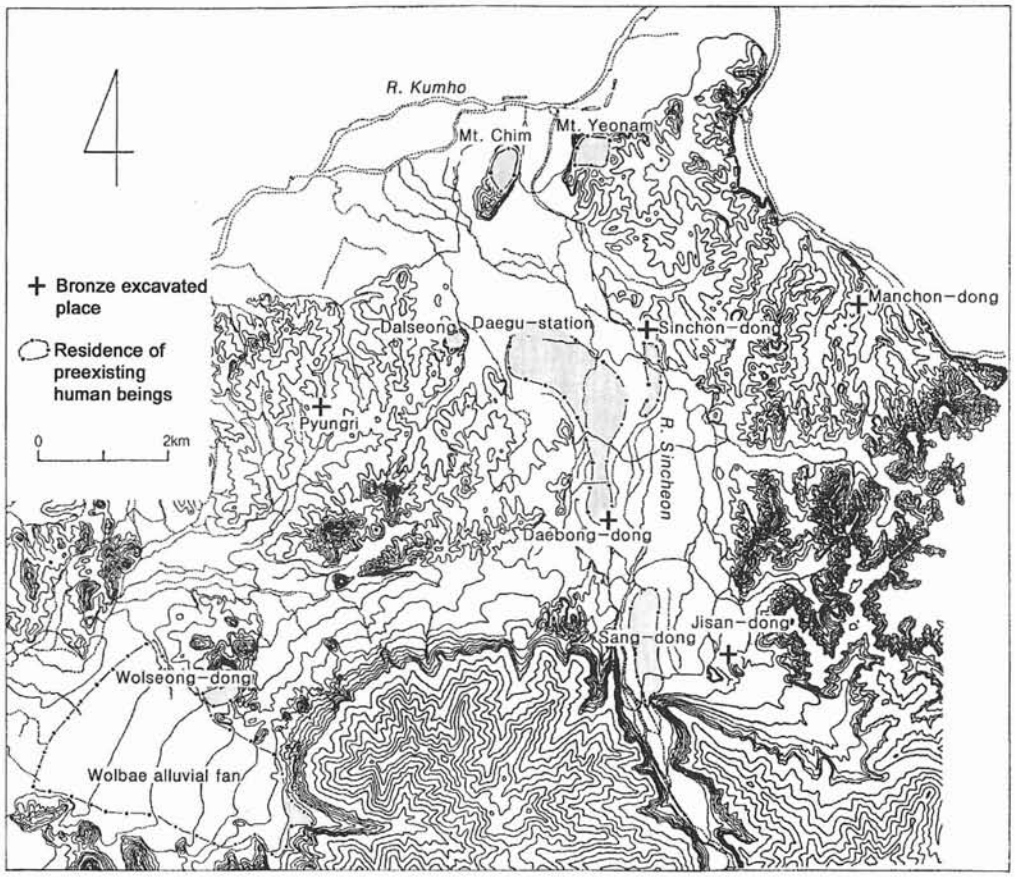
The bronze weapons made of 20-30% nickel (white brass) are weak enough to be broken easily and thus could not have been practical objects. We have no evidence that the bronze tools from this age were possessions of the commoners. Most of them were probably status-symbolic, so possessing and using them was likely confined to a powerful minority. Judging from the impractical and sacrificial characteristics of the bronze tools, (especially bronze weapons) during the pre-Iron Age, it is likely that the owners of the tools were not militarily significant, and that the community that produced the tombs was not strongly divided into political ranks. Judging from the fact that no practical bronze tools were found in the Daegu basin, the everyday implements during this period were still stone, wood, and bone tools. It is possible that iron implements were at least available if not common, judging from an iron plate, assumed to be coinage, found at Jisan-dong.

The Influence of natural environment on human activities

The bedrocks of the eroded hillsides, where bronze tools have been found, are mostly composed of shale or sedimentary rock of the Cretaceous period. The soil horizon of their summits is very thin or nothing because of long-term denudation. It represents mostly an A-C profile, called Daegu-tong, with soil thickness under 20 cm depth. Daegu-tong is fine yellow and brown sandy loam with composition gravel 15-40%, silt 46-56%, and clay 22.5%. The gravels in the soil are those isolated along the joints of the bedrock, therefore mostly sharp, angular or hexahedral angular with diameter ca. 10 cm. These areas can be easily damaged by soil erosion or drought owing to the attribution of easy transportation from the hills. The soil on these gentle hillsides (slope under 30°) is used today as dry field, grassland and orchards, but on slopes over 30° the land is forested, because of low productivity, low economic value and compact attribution of dry Daegu-tong. This soil is distributed widely in the Daegu basin and specially developed on the hillsides or ridges of sedimentary rock.

The soil of the valley plain between hillsides, called Yuga-tong, is developed out of saprolites of shale or transported materials from sedimentary rock of the eroded hills. This gray brown fine sandy soil is organic loam composed of gravel under 10%, silt about 60%, clay about

FIG. 7 - Location of human activities during the pre-Iron Age.



20% and is mainly used as rice fields. The thickness of soil horizon in the valley plain is over 100 cm. It is relatively fertile owing to rich humus. But the soil must be plowed deeply and manured abundantly to permit rice farming. Its structure is very compact and water is not drained well, and careful attention must be paid to the choice of crops and the management of the soil on dry fields or orchards, too. The stone, wood, and bone tools are so weak that it was probably very difficult for the residents to plow the fine and compact silt soil horizon of the valley plains of eastern and western eroded low hills.

We cannot understand why human living space was concentrated on the natural levee of Sincheon river and the Wolbae alluvial fan only during the Bronze Age, in spite of its being a profitable place for farming, and why people immediately moved to the hillsides and cultivated valley plain during the pre-Iron Age especially. The bronze tools representing the pre-Iron Age are not found on the living spaces of the Bronze Age, such as the natural levee of Sincheon river and the Wolbae alluvial fan, the Gumdan mudwall, or in the sites of hilly mountains around Mt Yeonam and Mt Chim. It is still unknown whether the Bronze Age inhabitants had moved to the valley plain or to other places.

The great tomb groups of the following the proto-Three Kingdoms Age are also found in the Bronze Age places the Wolbae alluvial fan, the eroded hills around the Gumdan mudwall, and Mt Yeonam. This implies these places had been inhabited continuously since the Bronze Age, even if bronze tools haven't been found from this Age. Menhirs with no bronze tools on the alluvial fan and the great tomb groups on the hillside are found at Goejon-dong in eastern Daegu. It suggests the possibility that the existing residents had sustained their culture steadily since the Bronze Age on the alluvial fan at Wolbae as well as Goejon-dong and on the Sincheon natural levee.

We attempted to reconstruct the shoreline in those days through the sea level curve of the West and East Coast of Korea during the Holocene. From the curve of sea level change at the Ilsan area on the West Coast, the sea level about 2,300 BP, the beginning of the pre-Iron Age, was relatively low, and the shoreline was regressed seawardly.

The hazard from floods was much less than in earlier ages, even if the regression didn't reach the Daegu basin, 190 km inland from the mouth of Naktong river. The natural levees and alluvial fans were therefore safe and were used as living space during the early pre-Iron Age. But the sea level rose again during the middle and later stages of the pre-Iron Age and reached its highest level during the proto-Three Kingdoms Age. This means that floods occurred more often during this later period.

There is no copper mine in the Daegu basin. Therefore bronze goods were probably not produced on the spot, but brought from northern regions. This implies two groups, earlier residents and immigrants from the north, coexisted in the Daegu basin in this period. But two groups with different cultures might occupy separate areas, in order to avoid trouble each other. The immigrants became dominant and lived probably on the eroded hillsides, which the original residents didn't use as residential areas and couldn't use as farm land. They probably didn't need to devote themselves to farming because of their superior position. And they could also obtain goods from the original residents in exchange for their superior knowledge of military affairs, farming, astronomy and geography so on.

THE PROTO-THREE KINGDOMS AGE - THE THREE KINGDOMS AGE

Distribution of sites

The period from the beginning of the Christian era to about 1,650 BP is called Kimhae- or the proto-Three Kingdoms Age in archaeology and the Samhan Age in ancient histories. The Three Kingdoms Age was sustained to the end of the 1,250 BP. After that, the Three Kingdoms were united under Shilla. The proto-Three Kingdoms Age is recognized as an actual Iron Age. The representative remains are groups of great tombs, mudwalls and mountain fortress walls. They are found at Pa-dong, Jisan-dong, Daemyung-dong, Bokhyun-dong, Wolseong-dong, Sangin-dong and Sindang-dong.

The most important characteristic of the great tombs of this period is that they are located along the ridges and on the slopes of hills but not on the natural levees, floodplains or alluvial fans. A number of groups of great tombs (54 tombs at Jisan-dong, 46 at Daemyung-dong, 87 Bisan-dong and Naedang-dong, 92 Bokhyun-dong and the rest at Wolseong-dong, Sangin-dong, and Sindang-dong) have been found in the Daegu basin, but there are probably many more than these (fig. 8, fig. 9). Relics such as earthenware, ironware, gold and silver ornaments, gilt-bronze crowns, horse equipment, and especially iron farming tools, have been excavated in abundance from the great tombs. The residents could have cultivated the hillsides or valley plains between the hills, which were covered with compact soils composed of silt and clay, using the iron tools. And they could have become a strong political power through the production, possession and trade of iron tools. Social status was probably restricted in the local community of the Daegu basin in those days, therefore only people with high class would be buried in the great

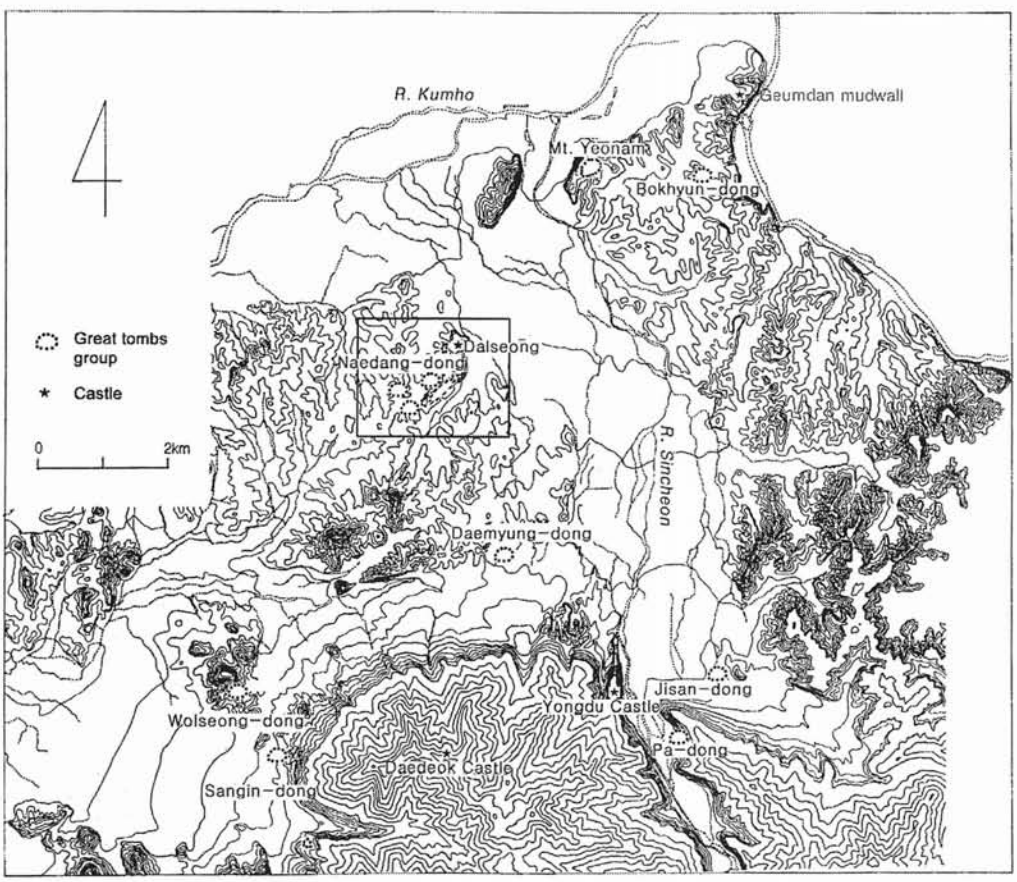


FIG. 8 - Location of human activities during the proto-Three Kingdoms Age (□ represents the area of fig. 9).

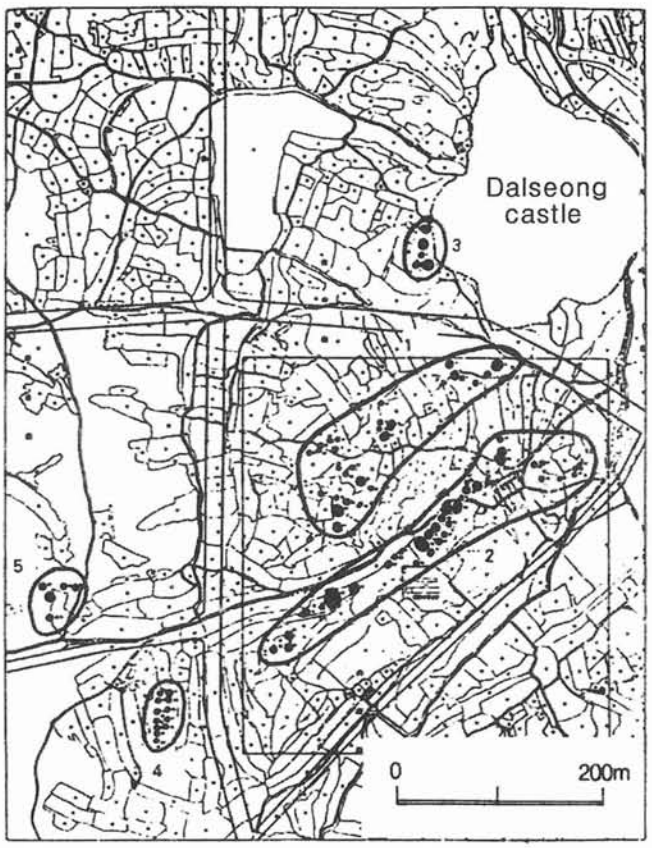


FIG. 9 - Distribution of the great tombs at Bisan-dong·Neadang-dong (The report of the relics during Chosun dynasty, 1923).

tombs on the hills. The ordinary people would have been buried on the slopes of hills. We assume that the ridges of hills, where tomb groups are crowded, were the center of each community in the Daegu basin. The appearance and development of iron tools had improved agriculture through such means as ox-plowing, while bronze tools gradually disappeared and fishing became less important.

The Influence of natural environment on human activities

Between 2,300 BP and 1,800 BP the sea level rose abruptly, and lagoons and wetlands were widely extended because of the rise of the underground water table on the coastal plain. There is no possibility the Daegu basin was influenced directly by the sea level rise because the height of the bed of Kumho river there reaches to 20-30 m a.s.l., and is very far from the mouth of Naktong river. But the basin might have been influenced by the globally warming climate that was a cause of the sea level rise.

Case studies about the effects of global climatic change on Korea have not to date been conducted. But the global warming climate in the 20th century has raised climatic hazards such as frequent heavy rain, landslides and so on, and also rising sea levels. Based on these facts, the climatic hazards from heavy rain were possibly increased by the relatively high sea level which peaked about 1,800 BP.

Rice farming has been conducted at Kangreung and Jumunjin since about 1,800 BP, since 1,800-1,900 BP at Pohang and since 2,300 BP at Bangeojin, on the east coast of Korea, based on the results of pollen analysis. It probably began around 1,900-1,800 BP at the Daegu basin because it is fairly close to Pohang city. The surplus from rice farming probably allowed population to increase considerably. The iron farming tools excavated from the great tombs and the historical documents about ox-plowing support this.

But the natural levee and floodplain came to be dangerous because of the floods triggered by climatic changes on the Daegu basin. Moreover, rapidly increasing population during this period created a need to cultivate the eroded lowland, such as low hills and valley plains for new farmland and living space. Iron tools made this possible. As a result, the frontier of human habitation in the Daegu basin moved into the east- and west eroded lowland since the pre-Iron Age.

Although the Wolbae alluvial fan shows a deficiency of bronze tools made during the pre-Iron Age, the adjacent hillside at Wolseong-dong has many tombs from the proto-Three Kingdoms Age. Also, inhabitants during the Bronze Age lived on the whole surface of alluvial fan, its boundary, and the middle- and upper surface of the fan. But sites from the proto-Three Kingdoms Age are found on other places as well, on the sides and ridges of the hills. It is still very difficult to discuss the movement of inhabitants correctly, because of the deficiency of evidence. But it is possible that frequent floods made the inhabitants move to higher land. The density of the pre-Iron Age great tombs is lower than that of the Bronze Age menhirs on the fan surface. It suggests that the alluvial fan lost its usefulness as farming land and the inhabitants left the fan because of more frequent floods. The likely source of floods is the Naktong river, because the Wolbae alluvial fan is closely linked to the backmarsh of the Naktong river.

THE CAUSES OF SPATIAL CHANGE ON THE HUMAN ACTIVITIES

During the period of transition from collecting and hunting to farming culture the main concerns of the inhabitants of the Daegu basin were likely to have been secure farmland, and making tools. Their choices were controlled by the climatic changes during the Holocene, the need for security from the floods on the floodplain, access to farmland from the residences and soil fertility.

The most serious hazard was flooding caused by heavy summer rains. The inhabitants were unable to cope with the Kumho and Sincheon rivers. Overflowing sediments from the river floor damaged fields and destroyed their raised borders. Therefore most of the floodplain of Sincheon river was wasted and uncultivated except for the natural levee and adjacent high area. But even these areas were unsafe during serious floods. The length of the rivers that the inhabitants could control by levees was limited to

those sections flowing between the eroded hills. Thus the spatial change for the human activities must be considered in the relation to natural environment and the development of tools during prehistoric and ancient times when the materials for tools were limited.

The bronze goods were used generally in the southern region of Korea during the pre-Iron Age, but they were not practical objects but sacrificial ones. Stone tools were the most practical, and bone and wood tools were also used. The human activity was confined mostly to the natural levee and alluvial fans, and not only agriculture but also fishing and hunting were important. Farming during the Bronze age was conducted on the alluvial plains, because soft sandy soils, Hwangryong-tong, were preferred in spite of the danger from floods. The compact soil, Yuga-tong, in valley plains in the Daegu basin is composed of silts and clays, very difficult to cultivate using stone tools.

It is presumed that two communities coexisted in the Daegu basin during the Bronze Age. The first one directly produced food through farming, fishing, and hunting. The second produced the stone tools and earthen wares needed for farming, fishing and hunting. This second culture lived and produced on the hillsides and hills as attested by remains such as those at Wolseong-dong, Mt Yeonam and Mt Chim.

Most of the bronze remains excavated have been from the pre-Iron Age. Iron goods unrelated to farming such as a horse equipment from this period have also been excavated. But increasing numbers of excellent iron and bronze tools from the latter part of the pre-Iron Age are being found. It indicates the improving political and social level of the community in the Daegu basin.

During the latter part of the pre-Iron Age the sea level reached its highest point, forcing inhabitants to move from the alluvial plain to the valley plain between the eroded hills and making necessary the use of iron tools. At this time there was also a group producing stone tools and earthen wares on the eroded hills as the relics of Wolseong-dong and Mt Yeonam and the relics scattered around Mt Chim indicate. The Gumdan mudwall also belongs to this group. To this date, stone, wood, bone and iron farming tools still haven't been found on the eroded hills or hillsides, except for those sites containing bronze and iron burial accessories. It indicates that a non-agricultural community settled there.

It is thought that three kinds of community existed in the Daegu basin during the pre-Iron Age. The first mostly produced foods on the natural levee and alluvial fan and was of the oldest culture, existing continuously from the Bronze Age. The second culture lived on the eroded hillsides and produced, delivered and traded stone tools and earthen wares. It also had existed since the Bronze Age. The third one was a non-productive governing group living on the eroded hills and hillside. It could have possessed exclusive space and taken charge of sacrificial rites involving bronze implements, such as swords, spears and mirrors. Iron tools were used in the Daegu basin during the proto-Three Kingdoms age. At the same time the eroded hillsides were being developed.

The residents didn't actually cultivate the eroded hillsides until the proto-Three Kingdoms age, indicating that the ruling group in the pre-Iron Age, who had the best technology, didn't employ themselves in agriculture. The southeast facies of the sedimentary rocks on the Daegu basin are gently inclined, therefore the residents probably settled on the south- and east sides of the hills, where is the left area of the Sincheon river and the central area in the Daegu basin at the same time. These gentle slopes provide broad living spaces and it is profitable to gain water along the flowing direction of water surface. Winds in winter in Korea are from the northwest, and though temperatures in the Daegu basin are higher than in previous centuries, yearly minimum temperatures are still about 5° lower than in other areas outside of the basin. The south- and east slope sides of the hills would have provided shelter from northwest winds during the cold winter.

SUMMARY AND RESULTS

We attempted to arrange the list of remains recorded in the literature and to correlate various changes in the natural environment with the location of cultivated fields, graveyards, and residential areas during the Bronze Age, the pre-Iron Age, and the proto-Three Kingdoms Age in the Daegu basin to show on the figures. The main results are as follows:

1. It is thought that the important territories of the residents during the Bronze Age were the Wolbae alluvial fan and the natural levee of Sincheon river. They were probably good sources for stone, wood, bone and antler implements, and were also important for farm land and residences because their geomorphic surfaces are composed of sands and gravels, softer than the compact soil of the valley plains between the eroded hills.
2. The practical tools during the pre-Iron Age were still made from stone, wood and bone. Therefore iron farm tools hadn't spread to this area yet. Such a constraint forced the inhabitants to maintain food production activities on the alluvial fan and natural levee. This assumption is supported by the likelihood that the danger of the floods was less than before because of the low sea level during the earlier stage of this Age.
3. Tne sites containing bronze accessories representing the pre-Iron Age were on the eroded lowland, such as low hills and hillsides. The bronze accessories were mostly not practical but ritual ones. Also, practical farming tools made from stone, wood and bone also haven't been found. The immigrants possessing the bronze accessories probably had higher social position than the residents of the floodplain and fans.
4. The living space on the Wolbae alluvial fan and natural levee of Sincheon river began to be dangerous after the Christian era to about 1,800 BP because of climatic change resulting in higher sea level during the later stage of the pre-Iron Age. Accordingly, the existing living spaces were often threatened by floods, and the steeply increasing population would have needed to develop new territories.

5. The floods of Sincheon river were diminished during the later stage of the Bronze Age, especially during the transitional stage to the pre-Iron Age, as deduced from the sea level fluctuation and the result of pollen analysis. But the existing living places on the alluvial plain of Sincheon river and the Wolbae alluvial fan were threatened from floods during the later pre-Iron Age. As a result, living space during the proto-Three Kingdoms Age was extended to the eroded hills owing to the difficulties of human activity on the older places. The iron implement made agricultural activity possible on the valley plains at the east- and west eroded lowlands composed of low hills.

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