Morphological Correlation and Chronology of Lower Terrace Formations of Southeastern Coast of Korea

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< English Abstract >

Terrace morphology is so conspicuous in the south eastern coastal areas. Coastal terraces can be divided into 5 main surfaces, including beach and coastal alluvial plain(AP, 4~5m), Low Terrace(LT, 8 ~ 25m), Middle Terrace(MT, 36 ~ 55m), High Terrace(HT, 63 ~ 86m) and upper High Terrace(uHT, above 90)m. Among them Lower Terrace Formation is distributed between 8m and 20m in altitude. Both Tephra deposited of LT2 formation and OSL datings of sand layers in LT 2 and LT 3 Formations support the age ofthe LT 2 formation is MIS 5d or 5e, most probably 5e. The age of LT 3 is interpreted MIS 5a, based on tephra production in organic mud layers and OSL dating of sand deposits just above the beach pebbles of the LT 3. Particularly the LT 2 Formation was formed in association with second major transgression, possibly equivalent to the well-known Monastirrian episode in the Mediterranean Sea.

Keyword : coastal terrace, low terrace, tephra, OSL, MIS 5

< 한글 요약문 >

제목 : 한국 남동해안 저위단구 퇴적층의 지형대비 및 형성시기 고찰

남한의 동남해안가를 따라 단구지형이 잘 발달하여 있으며, 해안단구는 해안충적면(AP,4~5m), 저위단구면(LT, 8~25m), 중위단구면(MT, 36~55m), 고위단구면(HT, 63~86m), 고고위단구면(uHT, above 90m)과 같이5개 주단구면들로 구분된다. 해안단구 중에서 고도 약 8m 에서 20m 부근에 저위단구퇴적층이 잘 발달하여 있다. 이들 퇴적층은 저위2면(LT2)과 저위3면(LT3)에 분포하는 유기니질층 내에 포함된 화산재 산출 특성과 사질층에 대한 광여기루미네선스(OSL) 연대측정을 실시하였다. 연구결과 , LT2면은 해양산소동위체시기(MIS)로 볼 때, MIS 5d 혹은 5e 에 해당하며, LT3면은 MIS 5a 로 해석된다. 특히 LT2퇴적층의 형성은 최종간빙기 최성기의 해침작용과 관련되어 형성되었다.

주요어 : 해안단구, 저위단구, 화산재, 광여기루미네선스(OSL), 해양산소동위체시기5 (MIS 5)

1. Introduction

Terrace stratigraphy of the southeastern coastal areas of Korea has been studied with the help of terrace mapping and chronology. Generally coastal terraces are regarded to be formed in response to coastal base level changes. Coastal terraces are conspicuously distributed along the southeastern coastal area (Kim, 1973; Oh, 1977; Jo, 1976, 1980; Oh, 1981; Lee, 1985, 1987; Kim, 1990; Kim et al, 1990; Lee and Kim, 1992a, 1992b; Choi, 2001; Kim, 2001 Kim, et al, 2004a, 2004b). In this study coastal terraces are divided into LT (above 8m~25m), MT (36m~55m), HT(63m~86m), and uHT(90m~130)m. This study aims to suggesting the distribution of coastal lower terraces with the help of key tephra production, particularly theages of the LT2 and LT3 Formations(Kim et al, 2004a).

This research covers Lower Terrace distributed from Bonggil site to Jeongja site in SE coast of Korea.

2. Coastal terrace mapping

The longitudinal and transversal distribution of coastalterraceformations are important not only for characterizing coastal landform, but also to unravel the uplift history of coastal landscape.Coastalterrace is characterized by spherical and round beach pebbles distributed at different altitudes along the coastline (Kim et al, 1990). terraces can be divided into 5 main surfaces, including beach and coastal alluvial plain(AP, 4~5m), Low Terrace(LT, 8 ~ 25m), Middle Terrace(MT, 36 ~ 55m), High Terrace(HT, 63 ~ 86m) and upper High Terrace(uHT, above 90m). Successive steps of coastal terraces can be mapped by altitude, landscape dissection feature(back edge and fore edge) and continuity of terrace surfaces or formations distributed along or vertical to present shoreline. The chronology of coastal terrace formations can be illuminated by the carbon radiometric age, OSLand tephra production, as well as their morphostratigraphic correlations.

3. Terrace chronology

Age dating of terrace sediments and terrace formation correlation to marine isotope stages are well known methods for terrace chronology (Muhs, 2000; Martinson, et al, 1987). Coastal terrace chronology in Korea has been reviewed by many Korean researchers, even though they are in some controversy with morphostratigraphical correlation (Cheong, 2002). Holocene alluvial plain is a lowermost base level in terrestrial part and distributed at about 4m to 5m in altitude. This Holocene Coastal Alluvial Plain (AP) is assumed to be formed initially during the Holocene Climatic Optimum (HCO) or Transgression-I (Flanderian transgression, ca 6,000-7,000yrsBP) (Fig.1). Below 25m in altitude, Lower Terrace are distributed at the altitude of about 8m to 25m (Kim et al, 2004a). In particular Lower Terrace 3 is distributed as low as 8m, and shows a sharp gradient change in fore edges in many sites. Lower terrace 2 is distributed in altitude between 14m and 18m, and Lower Terrace 1 at the level about 25m. Some horizons of

sedimentary deposits of Lower Terrace 2 and 3 Formations have been numerically dated by means of OSL methods, and also examined by their tephra contents (volcanic glass). The OSL age of Lower Terrace 2 Formation, distributed at the level of about 15-18m in Yonghanri site, indicates 111-112ka, which in turn hints the formation ages of basal beach pebbles, or of wave-cut platforms below OSL-dated sand deposits. A number of tephra evidences also support the age of Lower Terrace-II Formation. It is generally accepted that the age of Aso-4 is MIS 5c(ca 90ky), that of the Ata (100-120ky) is MIS 5d or 5e, and that of much younger AT tephra (ca 25ka) is marking the boundary MIS 2 and MIS 3. The Aso-4 tephra and the Ata tephra were found in Lower Terrace 2 of Yonghan site(Inoue et al., 2004). The former tephra (Aso-4) was also found near the Wolsong Nuclear Power Plant site, while the latter tephra (Ata) was found at many sites such as Wolsong gate(Wolsong), Yonghanri(Pohang) and Shinchangri (Janggi), Jeongja (Gangdong) (Kim et al, 2004a; unpublished data of the KEPRI). Each of these tephra was identified by the proper refraction index and chemical composition of glass and pyroxene. The amount of glass in those tephra is very small, and the tephra is regarded as having been experienced some reworking in general. Based on both OSL dating and the tephra evidences, the formation age ofLT 2 are correlated to MIS 5d,or MIS 5e (Kim et al, 2004a; Shackleton, et al, 1973).

The age of LT 3 can also be explained by tephra identification. First of all AT tephra was found in the upper part of both LT2 and LT 3 Formations, not in the form of any stratigraphical meanings, but produced as scattered fragments, particularly in latePleistocene paleosol layer, or as reworked materials in pedo-sedimentary layers. LT 3 is commonly superjacent by slope deposits, or old sand and gravel with some intercalations of muds as old as 30 to 40 ka, the top of which is frequently covered by patterened grounds formed under cold (boreal) climate regime during the last glacial maximum period (Kim et al, 2004b). Although a number of OSL dating have been reported and been in controversy with morphostratigraphy for last several years, Hataya's recent OSL result in Yonghan site of the northern part of

Pohang City is remarkably promising in matching morphostratigraphical meaning with numerical datings of the LT 3 formation situated at the level of about 10m to 12m. Hataya had attempted to relate terrace stratigraphy to numerical dating, and shows OSL ages of LT 3 formation range 58ka to 63ka. The formation age of basal beach pebbles, or wave-cut platforms of LT 3 is interpreted most probably as MIS 5a (Kim, et al, 2004a).

4. Conclusion

Terrace morphology is so conspicuous in the south eastern coastal areas. Lower Terrace Formation above 8m in altitude were formed during the Late Pleistocene. Tephra deposited just above the beach pebble layers of LT2 formation and OSL dating of LT 2 and LT 3 Formations support the age ofthe LT 2 formation is MIS 5d or 5e, most probably 5e. The age of LT 3 is interpreted MIS 5a, based on tephra production and OSL dating of sand deposits just above the beach pebbles in the LT 3 in Yonghan area. Particularly the LT 2 Formation was formed in association with second major transgression, possibly equivalent to the well-known Monastirrian episode in the Mediterranean Sea

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