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The Loess-Paleosol Stratigraphy of the West Coast of South Korea

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1. Introduction

Loess is a terrestrial clastic sediment, composed predominantly of silt-size particles, which is formed essentially by the accumulation of wind-blown dust(Pye, 1995). Loess-paleosol sequences are regarded to be related with the variation of the paleomonsoon system, because they contain nearly continuous records indicating paleoclimate variation especially in East-North Asia.

In this study, we aim to identify the proxy data for the paleoclimate used in Chinese Loess Plateau and to clarify the origin of Korean Loess by the geochemical analysis of the sediments, such as XRF and REE.

2. Data and Model Description

Three sets of loess-paleosol layer overlaid about 2.1m thick on the gravel layer of marine terrace on the south-western part of South Korea(N 36°15′50″, E 126°33′56″) were analzed in the field observation such as the soil color and soil crack, and magnetic susceptibility. Each layer from the top is named as L1S1, L1L2, S1, L2, S2, L3, Mn- and marine terrace layer respectively. Based on OSL ages and correlation with Dukso section in Korea(Shin, 2003), loess-paleosol sequence at Daecheon section was developed during MIS 8~3, marine terrace layer during MIS 9.

A-CN-K or A-CNK-FM diagram shows the characteristics between Korean and Chinese loess-paleosol clearly and Condrite-normalized REE patterns, $(La/Yb)_N$(8.88~14.01) and Ce anomalies have a similar origin to China, but differences by more precipitation in Korea than Chinese Loess Plateau.

3. Main contents

The sequence (DCSD in Fig. 2 and 3) is located at Woljeon-Ri, Nampo-Eup, Boyreong-Si, Chungcheongnam-Do (36°15.83′ N, 126°33.93′ E). The thickness of exposed section is about 4.5m, it consists of surface layer (artificial layer), loess-paleosol sequence and gravel layer of marine terrace from top to bottom and we can not find the bedrock. The topmost of the loess-paleosol sequence is 25.28m above sea level (depth 0cm) and marine terrace 22.88m, so we can observe 2.4m thick loess-paleosol sequence. Classification of the sequence was based on soil color, soil crack and MS. Nomenclature of each layer is L1S1 (palesosol layer), L1L2 (loess layer), S1 (palesosol layer), L2 (loess layer), S2 (palesosol layer), and L3 (loess layer), respectively from the top (Fig. 4). Chinese nomenclature to loess-paleosol sequence has traditionally used “L” for loess and “S” for paleosol combined with number (e.g. L1 for MIS 2~4 or S1 for MIS 5). Recently, because it is possible to divide layers more detailed, nomenclature like L1L1 (Chen et al., 1997) or L1LL1 (Porter, 2001; Xiao et al., 1999) is sometimes used.

Rare earth elements (REE) data of the sequence is shown in Table 2 and chondrite-normalized REE patterns in Fig. 6 with the previous studies in the CLP (Gallet et al., 1996; Jahn et al., 2001) and UCC (Upper Continental Crust; Taylor and McLennan, 1985). The gravel layer of marine terrace (DCSD Ma) and paleo-tidal flat samples (DC3 180, 210, DC5 120, 180) were also analyzed for provenance identification. The chondrite-normalized REE patterns of the sequence are characterized by enrich in light REE (LREE; $(La/Eu)_N$= 6.66~8.28) and flat in heavy REE (HREE; $(Tb/Lu)_N$=1.47~1.89). Moderately negative Eu anomalies (Eu/Eu^*=0.59~0.62) are found and the anomalies do not show the difference between loess and paleosol samples. Mn layer, marine terrace and paleo-tidal flat samples have moderately negative Eu anomalies (Eu/Eu^*=0.54~0.67) similar to the anomalies of loess and paleosol, but the range is wider than them of loess and paleosol. Because Eu anomalies and $(La/Yb)_N$ value of the sequence is close to UCC ($Eu/Eu^{*\approx 0.65,\ ((La/Yb)}{}_N \approx 10$; Taylor and McLennan, 1985), the loess-paleosol samples at the sequence can be thought as well-mixed and multi-recycled sediment (Gallet et al., 1998). The chondrite-normalized REE patterns of the marine terrace and paleo-tidal flat samples are enriched in LREE and flat in HREE close to the loess-paleosol samples. However, the degree is slightly different to the loess-paleosol samples. As the slope of LREE and HREE (i.e. $(La/Eu)_N$ and $(Tb/Lu)_N$) of the marine terrace is 5.67, 1.96 and paleo-tidal flat is 6.11~10.61, 1.50~2.39, respectively, their LREE is less enriched and flat than the loess-paleosol samples. Therefore, it is suggested that the sequence is composed by the material slightly different from marine and tidal flat material.

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