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研究报告

鼎湖山土壤有机质$\delta^{13}C$时空分异机制

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摘要

根据鼎湖山若干海拔部位土壤剖面薄层取样样品有机质含量、^{14}C测年及$\delta^{13}C$结果,研究土壤有机质$\delta^{13}C$时空分异机制.结果表明,不同海拔土壤剖面有机质$\delta^{13}C$深度特征受控于剖面发育进程,与有机质组成及其分解过程密切相关.植被枯落物成为表土层有机质以及表土层被埋藏后的有机质更新过程,均存在碳同位素分馏效应,有机质$\delta^{13}C$显著增大.相对于地表植被枯落物$\delta^{13}C$,表土层有机质$\delta^{13}C$增幅取决于表土有机质更新速率.表土有机质$\delta^{13}C$与植被枯落物$\delta^{13}C$均随海拔升高而增大,说明植被构成随海拔升高呈规律性变化.这与鼎湖山植被的垂直分布一致.不同海拔土壤剖面有机质$\delta^{13}C$深度特征类似,有机质含量深度特征一致,有机质 ^{14}C表观年龄自上向下增加.这是剖面发育过程中有机质不断更新的结果.土壤剖面有机质$\delta^{13}C$最大值深度与^{14}C弹穿透深度的成因和大小不同,均反映地貌与地表植被对有机碳同位素深度分布的控制.

关键词 土壤有机质；碳同位素；碳循环；亚热带；鼎湖山

分类号

Spatial and temporal differentiation of mountainous soil organic matter $\delta^{13}C$ in Dinghushan Biosphere Reserve

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Abstract

Based on the determinations of soil organic matter (SOM) content,SOM $\Delta^{14}C$,and SOM $\delta^{13}C$ of the samples collected by thin-layered sampling method, this paper studied the spatial and temporal differentiation of SOM $\delta^{13}C$ in the soil profiles at different altitudes in Dinghushan Biosphere Reserve.The results showed that the vertical differentiation of SOM $\delta^{13}C$ at different altitudes was controlled by the development of soil profile,and closely correlated with the composition of SOM and its turnover processes.The fractionation of carbon isotope was happened during both the transformation of vegetation debris into topsoil organic matter (OM) and its regeneration after the topsoil buried,which

resulted in a significant increase of SOM $\delta^{13}C$.Relative to plant debris $\delta^{13}C$,the $\delta^{13}C$ increment of topsoil OM was more dependent on its turnover rate.Both the $\delta^{13}C$ of plant debris and topsoil OM increased with altitude,indicating the regular variation of vegetations with altitude,which was consensus to the vertical distribution of vegetations in Dinghushan Biosphere Reserve.Soil profiles at different altitudes had similar characteristics in vertical differentiation of SOM $\delta^{13}C$, vertical distribution of SOM content,and increasing apparent age of SOM ^{14}C with soil depth,which were resulted from the successive turnover of SOM during the development of soil profile.The maximum depth of SOM $\delta^{13}C$ in soil profile was different in origin and magnitude with the penetration depth of ^{14}C produced by nuclear explosion in the atmosphere,indicating the controlling effects of topography and vegetation on the distribution of SOM carbon isotope with soil depth.

Key words

Soil organic matter ^{14}C Carbon cycling Subtropical zone Dinghushan Biosphere Reserve

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