

Source of soil CO₂ from carbonate dissolution and organic decomposition in karst area-evidence from carbon isotope

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Aim

By using stable carbon isotope, the CO₂ sources of soil profiles developed on limestone, dolostone and claystone basements respectively were studied comparably in Central Guizhou.

Results

Our results of stable carbon isotope (PDB/‰) are showed in the table below.

Depth/cm	Limestone		Dolostone		Claystone	
	Soil CO ₂	Soil organic matter	Soil CO ₂	Soil organic matter	Soil CO ₂	Soil organic matter
0	-10.576	-	-13.653	-	-10.571	-
5	-11.424	-22.423	-15.734	-17.182	-10.467	-23.748
10	-12.480	-19.488	-11.899	-17.094	-17.128	-21.416
20	-12.811	-17.750	-13.212	-17.170	-20.234	-21.379
30	-13.027	-17.002	-13.656	-17.485	-20.865	-22.201
40	-13.279	-17.275	-14.271	-18.155	-21.485	-22.173
50	-13.198	-17.582	-	-	-21.485	-20.766
60	-13.492	-	-	-	-	-

The $\delta^{13}\text{C}$ of limestone is 1.849‰ and that of dolostone is 1.821‰

Discussion and conclusion

Below 20cm, obviously, the $\delta^{13}\text{C}$ value of CO₂ in soil profile developed on limestone is appreciably more positive than that on dolostone and that on claystone is most negative. Without regard to atmospheric CO₂, this part of soil CO₂ in karst area can be considered to come mainly from two sources: One is the decomposition of soil organic matter, another is the dissolution of carbonate under acid influence. The contribution ratio of two sources can be calculated using the method of isotopic compositions of two-endmember. The ratio of CO₂ coming from dissolution of carbonate rock in the deep soil CO₂ is calculated to be about 21% ~ 25% in soil profile developed on limestone and 19% ~ 21% in soil profile developed on dolostone respectively. The similar conclusion was obtained by Hsieh et al.

Reference

J.C.C Hsieh et al., (1999), *Geochim Cosmochim Acta*, 63(6): 767-783

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Fe-Mn-S Cycling and the Distribution of Biomacromolecules and SRB in Lake sediments from Southwest China

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Microbes can influence Fe-Mn-S cycling in lake sediments. The application of molecular biological methods to investigate the occurrence and distribution of bacteria in the environment can reveal some biogeochemical process^[1].

Two sediment cores were collected at Lake Aha and Lake Baihua, which located in Guizhou Province, Southwest China. One is 42 cm long with 9 cm long of overlying water under 22 meters depth in Lake Aha, and another 24cm long with 27cm long of overlying water in Lake Baihua. Both were dissected as 1cm interval.

Contents of Protein and Nucleic Acids were measured. DNA, Extracted from every layer of sediments were used as PCR templates. The specific PCR primers are able to amplify DNA from *Desulfomaculum*, *Desulfobubus*, *Desulfobacterium*, *Desulfobacte*, *Desulfococcus-Desulfonema*, *Desulfosarcina*, *Desulfovibrio-Desulfomicrobium* in sediments.

Concentration of Mn decreases gradually from suspend layer to deep sediments. Fe content is low among 4 cm layer sediments and its peak is located in 5 cm and 11 cm sediments. SRB are found to enrich in upper parts of sediment cores. DNA content is relatively high above 10 cm sediments, and Protein content is high above 16 cm in sediments. Peak of protein content is in the range of upper 10 cm sediments in both lakes. Amino acid content increases gradually from suspend layer to 6 or 7 cm sediments. The variation of protein and amino acids also can hint the activities of microbes in sediments.

Sulfate reduction is dominated in upper layers of sediments, with the produced H₂S combining with Fe²⁺, which is from Fe reducing, and Mn is also reduced in upper layers but it is not able to combine with H₂S. So they have different geochemical characteristics.

Reference

1. Ravenschlag K., Sahm k. and Knoblauch C. et al. (2000), *Appl. Environ. Microb.* 66(8),3592-3602.